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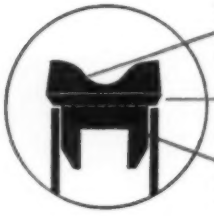

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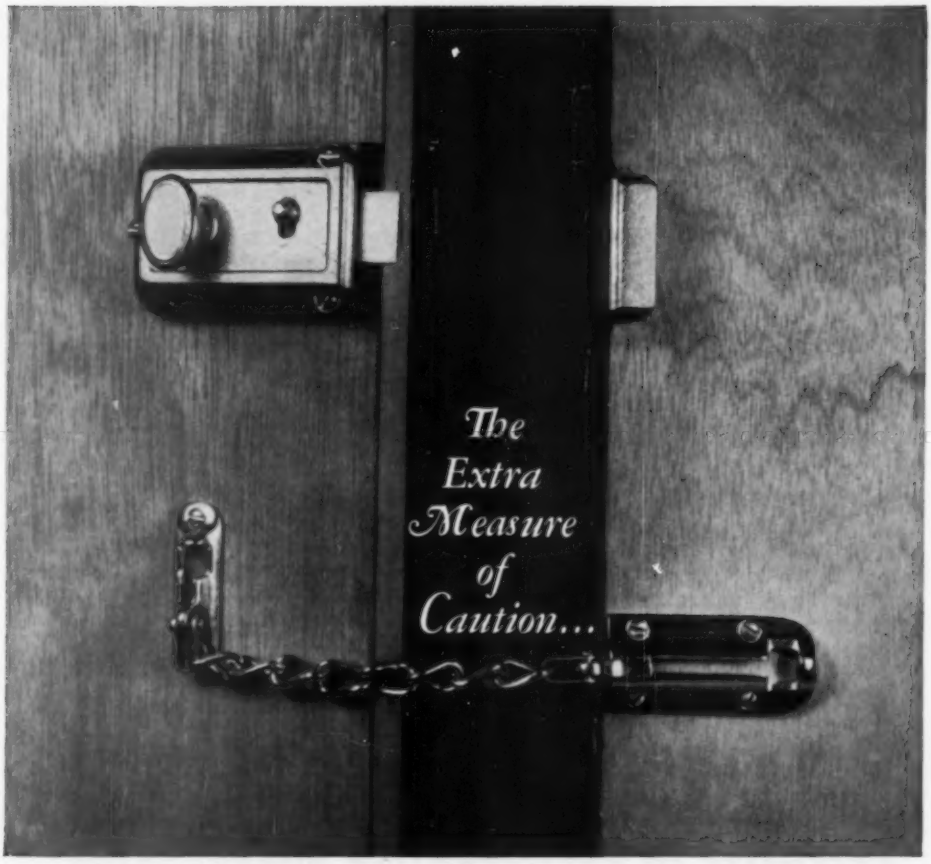

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*Newcomer, V. D., **et al.**: A.M.A. J. Dis. Child. **99**:585, 1960.

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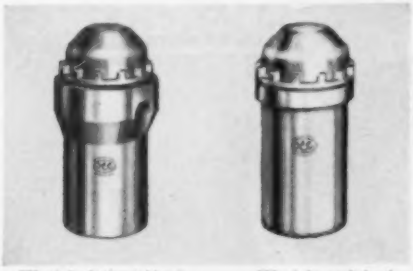
MAXIMUM SAFETY MEASURES NEEDED

If laboratory work is to be made completely safe for scientist and technician, this "aerosol effect" must be eliminated. Procedures which utilize maximum safeguards will insure protection of personnel.



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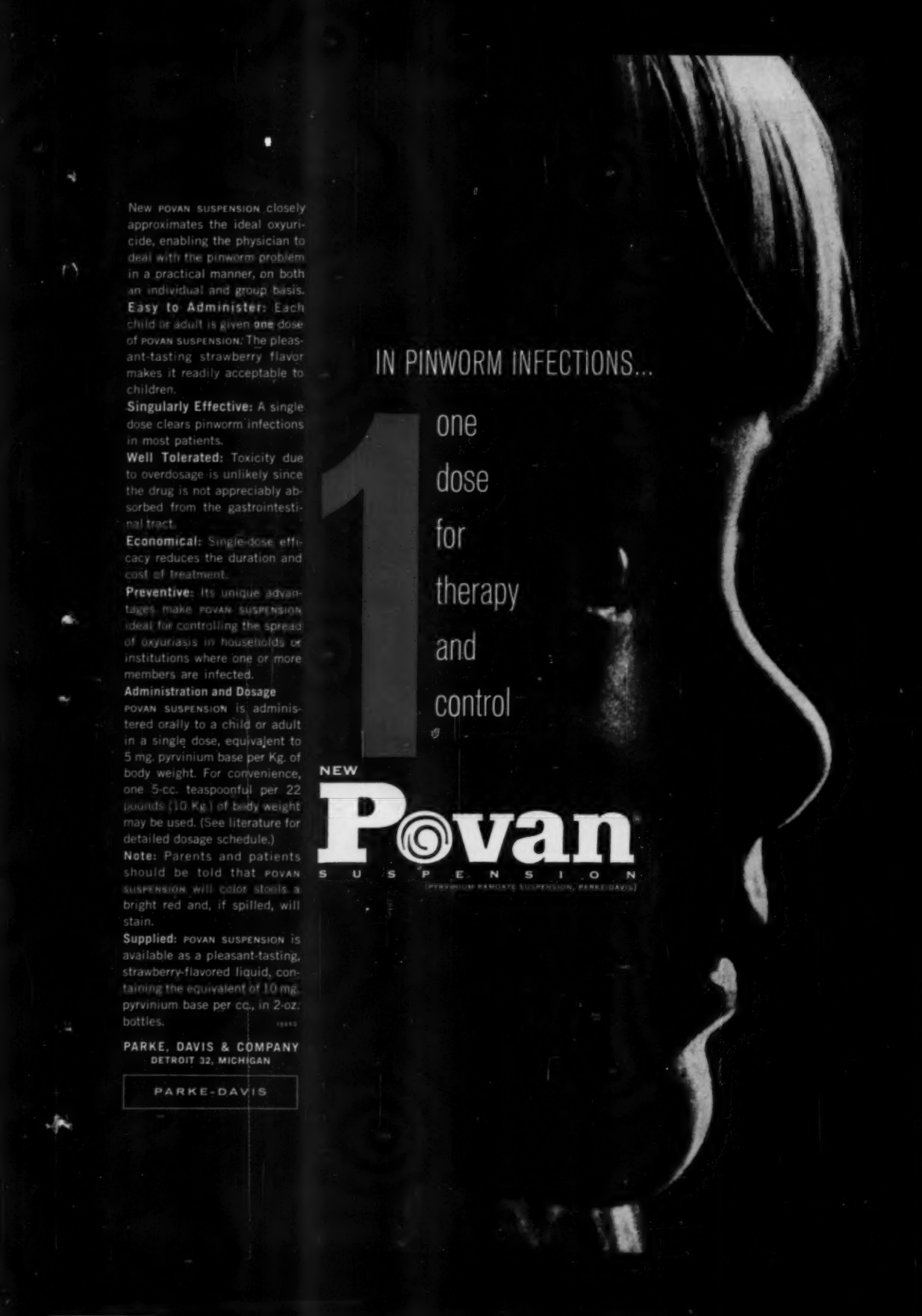

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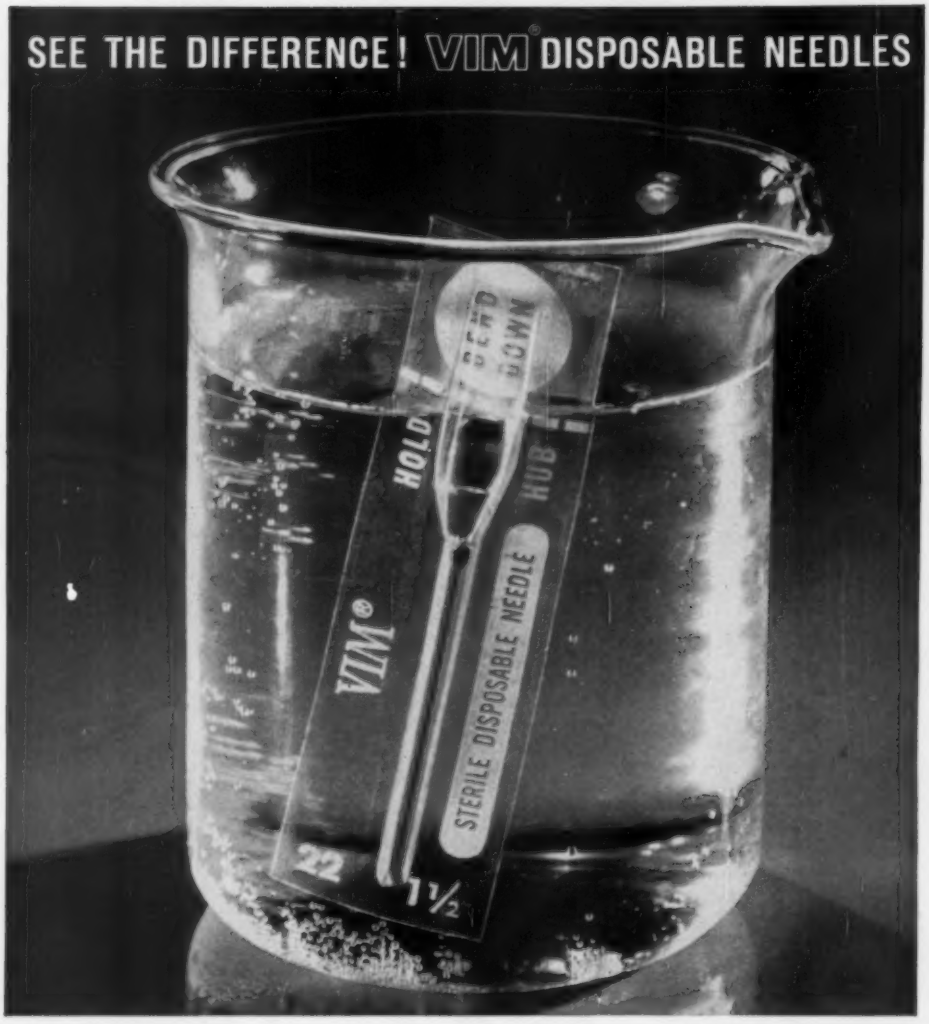

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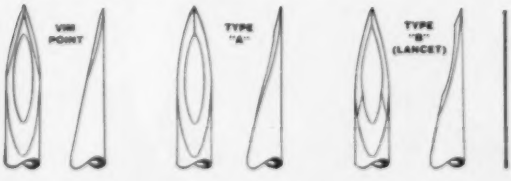

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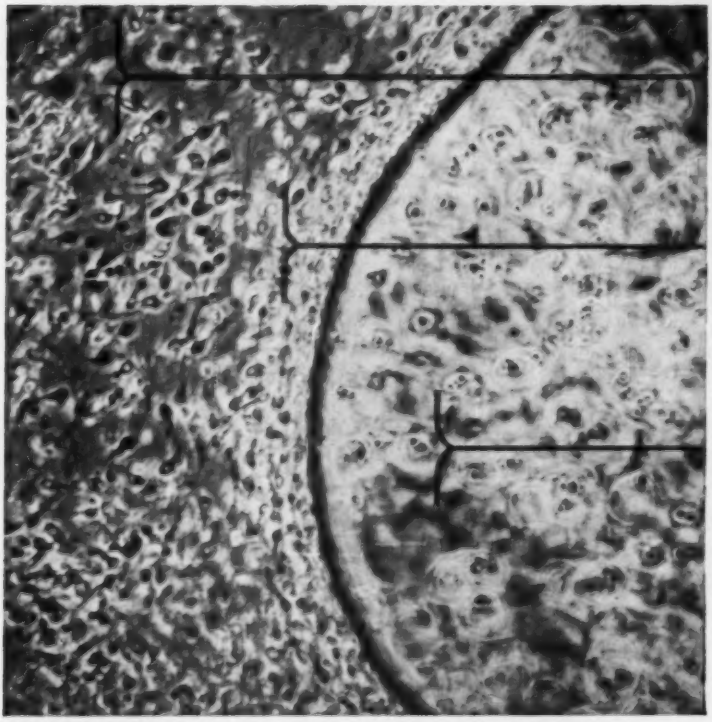

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1. Goldstein, L. Z.: Obst. & Gynec. 10:133 (Aug.) 1957.
2. Finkelstein, R., and Goldberg, R. B.: Am. J. Obst. & Gynec. 78:657 (Sept.) 1959.

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A well-balanced moderate low-fat breakfast for teen-age girls

Teen-age girls comprise the most poorly fed group in our population today according to nutrition researchers. During this critical growth period, well over half of them skip or skimp on breakfast, the most important meal of the day. As a service to those advising teen-age girls and their parents, this *well-balanced, moderate low-fat basic cereal and milk breakfast* shown in the chart below merits consideration. Its moderate low-fat content of 10.9 gm. provides 20 per cent of the total calories. This is in keeping with the modern trend toward a moderate reduction of dietary fat for all ages. For "Girls, 13 to 15 years," it is *well-balanced* and provides about one-fourth of the recommended daily dietary allowances! The Iowa Breakfast Studies demonstrated that *a basic cereal and milk breakfast was nutritionally efficient* for the young and old alike.

Recommended Daily Dietary Allowances and the Nutritional Contribution of a Basic Cereal and Milk Moderate Low-Fat Breakfast*

Menu: Orange Juice—4 oz.;
Cereal, dry weight—1 oz.;
Whole Milk—4 oz.; Sugar—1 teaspoon;
Toast (white, enriched)—2 slices;
Butter—5 gm. (about 1 teaspoon);
Nonfat Milk—8 oz.

Nutrients	Calories	Protein	Calcium	Iron	Vitamin A	Thiamine	Riboflavin	Niacin equiv.	Ascorbic Acid
Totals supplied by Basic Breakfast	503	20.9 gm.	0.532 gm.	2.7 mg.	588 I.U.	0.46 mg.	0.80 mg.	7.36 mg.	65.5 mg.
Recommended Dietary Allowances—Girls, 13 to 15 Years (49 kg.—108 lb.)	2600	80 gm.	1.3 gm.	15 mg.	5000 I.U.	1.3 mg.	2.0 mg.	17 mg.	80 mg.
Percentage Contributed by Basic Breakfast	19.3%	26.1%	40.9%	18.0%	11.8%	35.4%	40.0%	43.3%	81.9%

Cereal Institute, Inc.: Breakfast Source Book. Chicago: Cereal Institute, Inc., 1959.
Food & Nutrition Bd.: Recommended Dietary Allowances, Revised 1958. Natl. Acad. Sci.—Natl. Research Council Publication 589, 1958.
Watt, B. K., and Merrill, A. L.: Composition of Foods—Raw, Processed, Prepared. U.S.D.A. Agriculture Handbook No. 8, 1950.

**The allowance levels are intended to cover individual variations among most normal persons as they live in the United States under usual environmental stresses. Calorie allowances apply to individuals usually engaged in moderate physical activity. For office workers or others in sedentary occupations they are excessive. Adjustments must be made for variations in body size, age, physical activity, and environmental temperature.*

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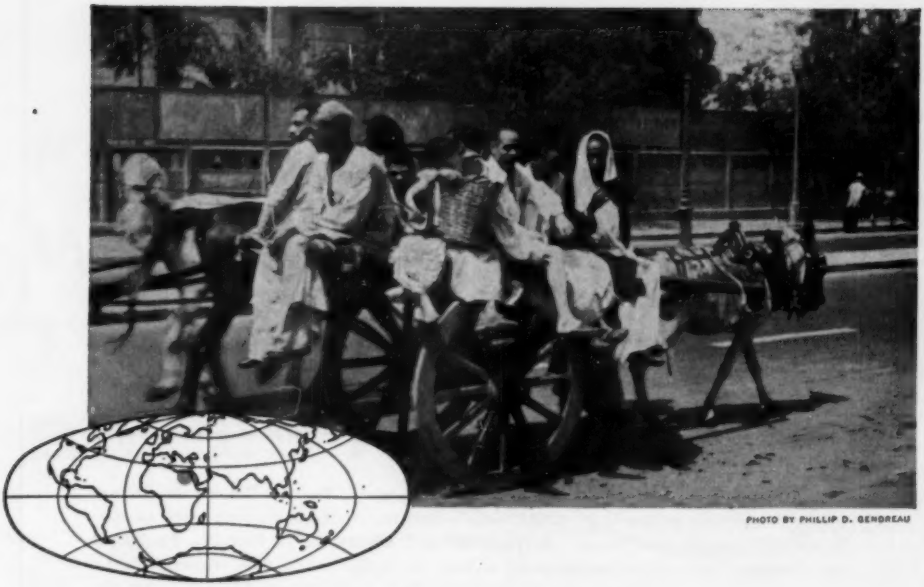

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In New York State where reporting of staph infections is now state law, dangers from staph in the home were discussed by a panel and reported on by Dr. Andrew C. Fleck in the March 15, 1960, issue of the New York State Medical Journal. Death of a mother from staphylococcal pneumonia followed exposure through her child, first hospitalized for chronic cystic fibrosis. In another family, ten out of eleven members, and their public health nurse, were afflicted with chronic furunculosis.

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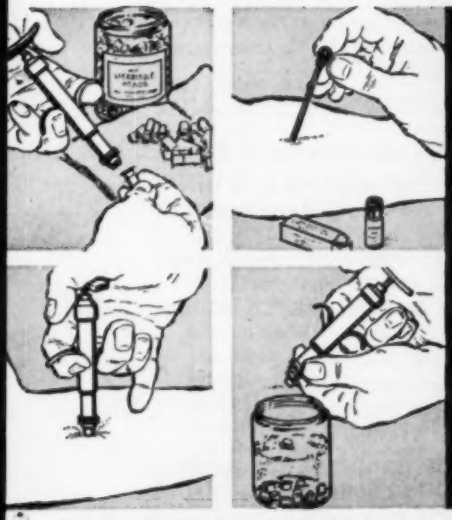

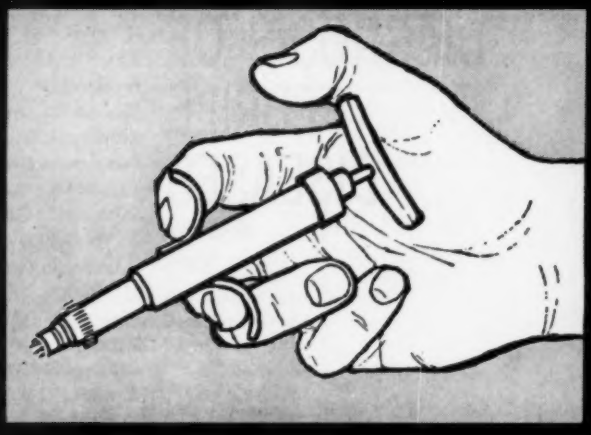

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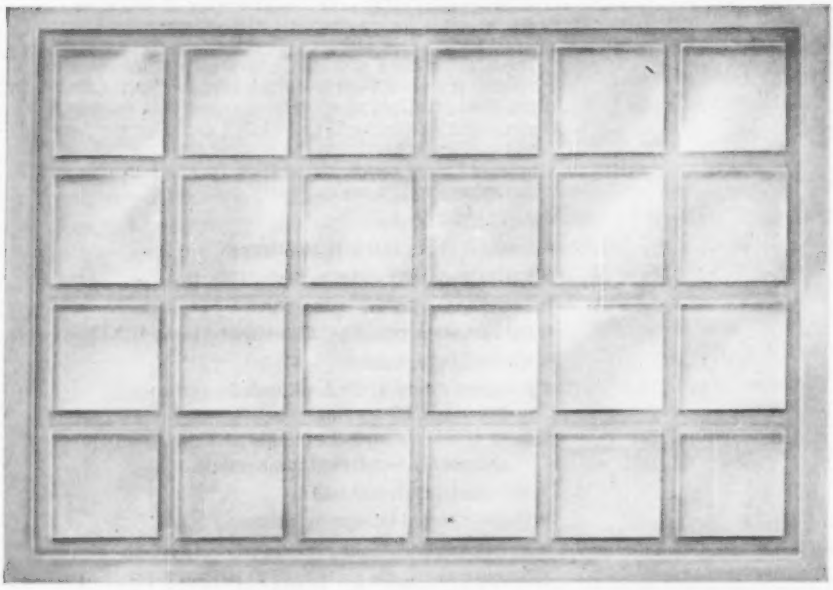

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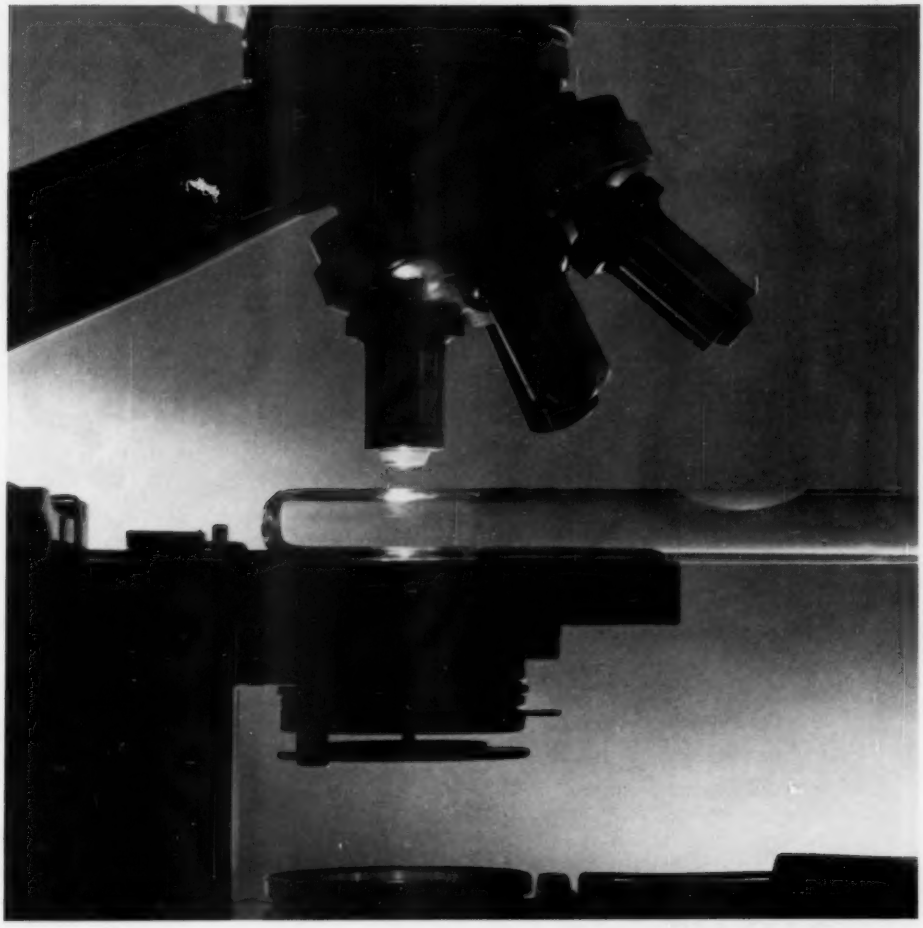

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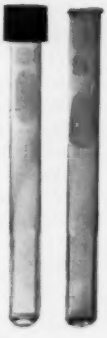

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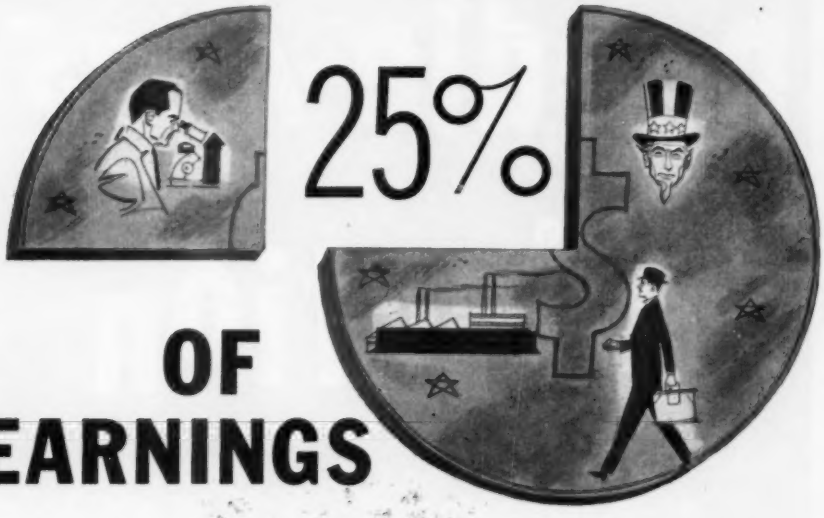

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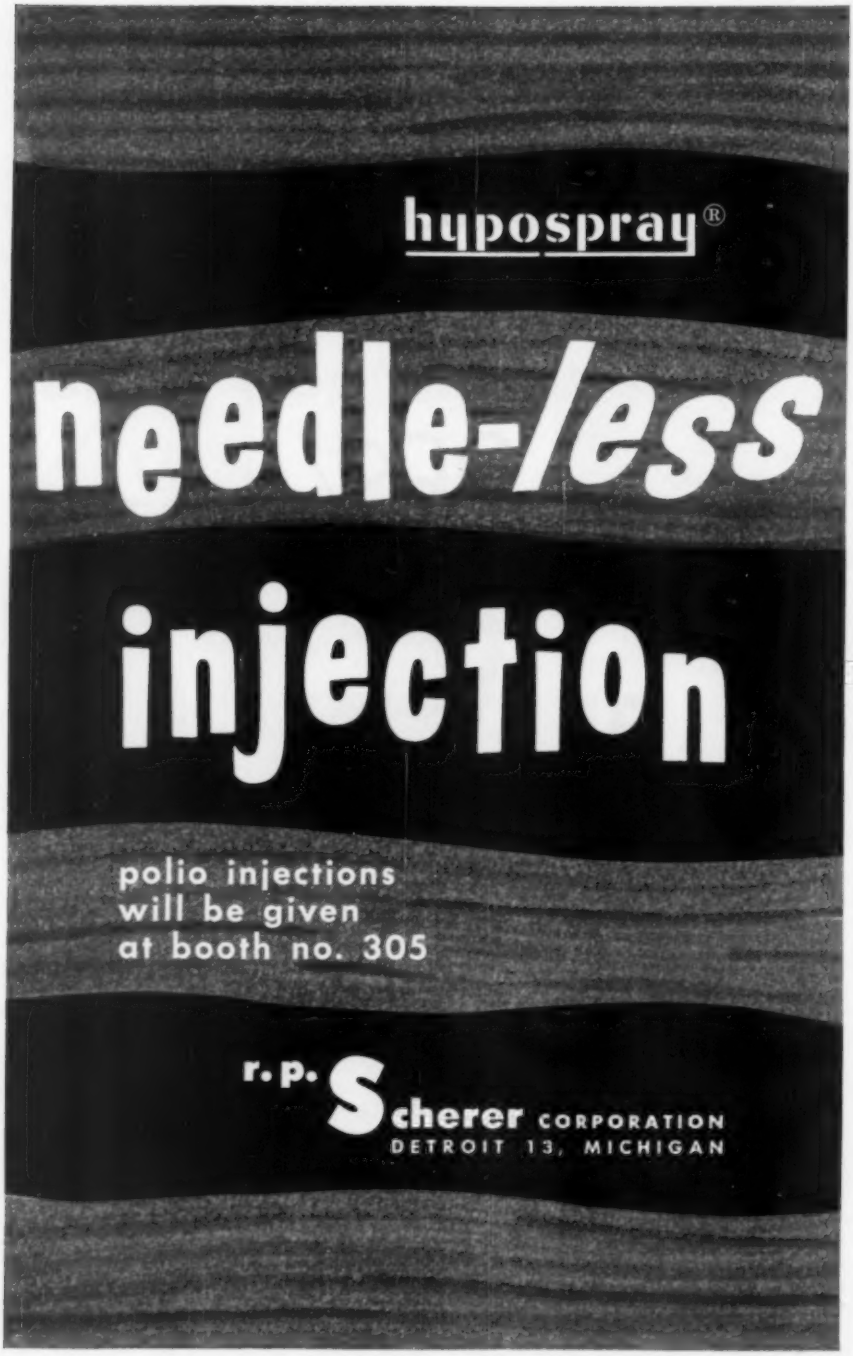
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Journal of Public Health

A study of lung cancer cases and controls disclosed a number of occupations that appeared to have an increased risk of pulmonary cancer. To examine this possibility a prospective study was undertaken. The results of a preliminary analysis are presented here, and some of the sources of uncertainty are discussed.

LUNG CANCER MORTALITY EXPERIENCE OF MEN IN CERTAIN OCCUPATIONS IN CALIFORNIA

John E. Dunn, Jr., M.D., M.S.P.H., F.A.P.H.A.; George Linden, M.P.H.; and Lester Breslow, M.D., M.P.H., F.A.P.H.A.

DURING THE PERIOD 1949-1952 a case-control study among male lung cancer cases and matched controls in 11 California hospitals yielded data on occupation and tobacco use as principal variables. The findings in regard to tobacco use supported the now well established positive association of cigarette smoking and liability to death from lung cancer.

In considering the distribution of occupations between cases and controls, it was arbitrarily decided that any case or control would be assigned to a specific occupation if he had worked at least five years in the occupation. Interest was further limited to those occupations to which at least five cases or five controls had been assigned.

This study[1] disclosed a number of occupations to be more frequent among the lung cancer cases than among the controls. For one of these, welders, the excess among cases as compared to controls was statistically significant; for a number of others, the excessive frequency among cases as compared to controls bordered on significance.

On the basis of these findings, we undertook a prospective study in which populations of workers engaged in the suspect occupations were assembled and their lung cancer experience observed during succeeding years through a

search of death records. The study began in 1954, and this report is based on death experience through 1958.

Plan of Study

The populations assembled for study were limited to men in the age range 35-64 years. Younger men were excluded because their lung cancer experience would contribute little to the study while their numbers would add considerably to the population lists being searched for matching with recorded deaths. Older workers were excluded because of their small numbers and the uncertainty of the applicable death rates. Estimates indicated that populations ranging between five and ten thousand would provide reasonable assurance of identifying occupations having as little as a twofold increased risk of lung cancer. An expected number of at least 14 lung cancer deaths (when a twofold risk would provide a significant observed number of 21 cases or more with a probability of 0.93) has been shown necessary to fulfill these conditions.[2] A population of the size being sought would produce such an expected number within five years of observation.

Exploration as to the best means of collecting populations suitable for the study led to a decision to work through union organizations. Local union offices provided names and addresses of workers in the occupations of interest, and questionnaires were mailed with a covering letter requesting the furnishing of identifying data and information as to length of time and nature of work experience in the particular occupation. Cigarette smoking experience was also requested.

Further details as to the mechanics of the data collection phase of the study were given elsewhere.[3] Suffice it to say here that the response rate averaged about 85 per cent after three mailings.

In addition to the specific occupational groups, the study included a control group representing workers from two public utility electric companies. From this group the few workers engaged in any of the suspect occupations were excluded. The remainder represented a broad spectrum of occupations, as one might expect in the expansion, maintenance, and power distribution of large public utility organizations.

The questionnaires used for data collection from the members of the various occupational groups were as simple and brief as possible in the interest of maximum response. Identifying information, besides establishing age and sex, permitted subsequent death certificate matching. The Social Security number is extremely useful for this purpose. Smoking practice was confined to cigarette use, years of smoking, and current or last average daily consumption. The respondent identified himself in his occupation and the length of time he had been in the occupation. Questions about each specific occupation of interest established the specific nature of the work. Welders, for example, were asked as to kinds of welding equipment, welding rods, and metals with which they worked. Some sheet metal workers do welding and some do not. Within the culinary trade, cooks had to be distinguished from other kitchen workers such as pantrymen, kitchen helpers, waiters, and others. Respondents thus identified themselves as belonging not only in the specific occupations being studied but also in broad subclasses within each occupation for separate examination.

Results

Table 1 gives the number of men collected for each of the study populations within the age span being studied, and their percentage distribution by ten-year age groups. The welders and

cooks represent the two extremes in regard to age distribution—the former being the youngest and the latter the oldest. The controls lie near the middle range in respect to age.

Not all the occupations shown in Table 1 were suspected of increased lung cancer risk from the original case-control study. Some came into the present study as by-products of collecting the populations in suspect occupations and are included because of their sizable numbers and for such help as they might provide in understanding the characteristics and biases peculiar to the study. The sheet metal workers not doing welding are one such group; plumbers not working with asbestos another. Two suspect groups—electric bridge crane operators and marine engineers and firemen—could not be found in sufficient numbers for study but are included because they were suspect in the original case-control study. Printers were included because it was possible to collect an adequate population easily, and they have been reported to have an increased lung cancer risk.[4]

To determine the significance of the lung cancer mortality experience in these populations over a period of time, it is necessary to calculate the man-years of exposure to risk of mortality and also to allow for the aging of the populations. The returns from mailed questionnaires for any particular occupation came in over many months. To simplify correction for aging (and not introduce an appreciable error), we considered that each man contributed at his stated age the person-months remaining of the calendar year after the date the questionnaire was completed. He was counted one year older for each succeeding person-year (calendar). This procedure led to the accumulation of person-years by each study population, at the end of calendar year 1958, shown in column (2) of Table 2. We did not correct for person-years lost as a result of general mortality during the time these populations have been followed. Such a correction, however, would involve a person-year's reduction in the order of 2 per cent for any group at the end of 1958. The expected lung cancer deaths, discussed further on, would be reduced by about half a case for the painters, who have the largest expected number, and something less

Table 1—Males 35–64 Years of Age in the Occupational Study Populations

Occupational Group	Total Number	Per cent of Total in Age Groups		
		35–44	45–54	55–64
Welders	10,235	58.0	32.6	9.4
Painters	12,512	36.0	37.4	26.6
Cooks	9,598	30.1	42.1	27.7
Asbestos workers	7,836	38.8	37.3	23.8
Printers	5,424	38.3	39.6	22.1
Marine engineers	1,380	39.7	35.1	25.2
Electric bridge crane operators	318	41.8	39.6	18.6
Plumbers (no asbestos)	7,909	45.1	35.3	19.5
Sheet metal workers	3,013	47.8	33.0	19.1
Controls	8,569	41.7	34.3	24.0

Table 2—Man-Years of Experience for Each Occupation Through 1958, and Observed and Expected Lung and All Cancer Deaths for This Period

Occupational Group (1)	Man-Years Through 1958 (2)	Cancer Deaths*						
		Lung Cancer				All Cancer Other Than Lung		
			Ratio				Ratio	
		Observed (3)	Expected (4)	Observed/ Expected (5)	Corrected for Smoking (6)	Observed (7)	Expected (8)	Observed/ Expected (9)
Welders	42,801	19	16.9	1.12	0.98	43	43.6	0.99
Painters	37,870	35	24.1	1.45	1.26	51	59.9	0.85
Cooks	26,108	23	16.8	1.37	1.41	32	41.7	0.77
Asbestos workers	23,603	19	13.7	1.39	1.22	30	34.3	0.87
Printers	14,292	2	7.7	0.26	0.25	26	19.6	1.33
Marine engineers	5,757	5	3.7	1.35	1.08	8	9.0	0.89
Electric bridge crane operators	1,068	0	0.5	–	–	0	1.4	–
Plumbers	24,908	16	12.9	1.24	1.07	23	32.5	0.71
Sheet metal workers	11,763	3	6.2	0.48	0.48	14	15.6	0.90
Controls	34,333	17	19.8	0.86	0.86	33	49.5	0.67
Totals	222,503	139	122.8	1.13	–	260	307.2	0.85

* Rates per 100,000 for age groups 35-44, 45-54, 55-64, and 65-69 years were for column (4) 8.2, 45.3, 123.2, and 193.7; for column (8) 36.8, 106.5, 289.1, and 557.1.

than this for the other groups. (For interoccupational group comparisons such correction is of little importance.)

Columns (7) and (3) of Table 2 indicate the cancer deaths for all but lung cancer deaths (hereafter referred to as other cancer), and the lung cancer deaths (I.S.C. codes 162-163) that have occurred in the occupational and control populations. An immediate question arises as to the rates to use for computing expected numbers of lung cancer and other cancer deaths to compare with these observed numbers. California has undergone tremendous population growth since 1950 and population estimates by age and sex are uncertain. Such estimates as are available for the California male population in recent years indicate that any change in age-specific rates for men 35-64 years of age for other cancer mortality has been slight. For this preliminary analysis, then, and until the 1960 Census enumeration is available, the 1950 age-specific other cancer rates yield the expected numbers in column (8) of Table 2. The ratio of observed to expected other cancer deaths is less than one for all study groups except printers. The controls are most deficient in other cancer, having only about two-thirds of the expected number, and for all groups taken together the observed number is 85 per cent of the expected number. This apparent deficit in other cancer deaths will be discussed later.

Any uncertainty about the proper age-specific other cancer rates to use is minor compared to finding suitable

Table 3—Cigarette Smoking Practices of the Occupational Populations and Controls

Amount of Cigarettes Smoked	Population Groups—Percentage Distribution*										
	Controls	Welders	Painters	Cooks	Asbestos Workers	Printers	Marine Engineers	Electric Bridge Crane Operators	Sheet Metal Workers	Plumbers
None	28.1	18.4	17.1	26.0	18.6	23.8	17.0	19.6	24.6	18.9
5	4.4	3.1	3.5	6.1	3.6	4.0	3.1	4.1	3.8	2.4
½ pack	12.6	13.7	14.1	17.3	13.4	15.0	11.0	14.9	16.0	12.3
1 pack	37.1	45.0	45.9	34.0	44.2	38.6	38.1	43.7	40.4	44.0
1½ packs	12.8	14.6	13.3	11.0	13.9	13.1	17.8	13.3	10.3	16.3
2 packs	4.1	4.4	4.9	4.5	5.2	4.8	11.9	2.8	3.2	4.9
Not stated	1.0	0.8	1.2	1.2	1.1	0.8	0.9	1.6	1.7	1.2

* Does not include 193 (0.3 per cent of total) for which information on smoking practice was not returned.

age-specific lung cancer rates for computing expected numbers. Lung cancer mortality rates for males have continued to climb since 1950 but how fast and whether the rate of ascent is different for different age groups is uncertain. The estimates of increase for the total United States seemed more reliable than California data because of California's rapid population change. The estimated increase, based on United States data, from 1950 to 1956 for the male age-specific respiratory cancer rates were as follows: 35-44 years, 22 per cent; 45-54 years, 23 per cent; 55-64 years, 40 per cent; 64-69 years, 65 per cent. The corresponding California 1950 age-specific lung cancer rates were increased by these percentages and used to compute the expected numbers of column (4).

Inspection of the observed and expected lung cancer deaths in the various occupational groups indicates that the ratios are all greater than 1.0, except for the sheet metal workers, the printers, and the control population. The only significant deviations from the expected number are an excess of observed lung cancer deaths among painters ($10.9 > 2\sqrt{24.1}$) and a significant deficiency in lung cancer deaths among printers. As noted above, this latter occupational group had an excess of other cancer deaths.

An important factor to be considered in the lung cancer experience of a population is its smoking practices which will be considered next.

Cigarette Smoking Habits

The information collected on smoking practices was limited to cigarette smoking, since the association of this habit with increased risk of lung cancer is firmly established and quantified. Cigarette smokers included anyone smoking cigarettes regularly for at least one year. The majority of regular cigarette

smokers apparently think of their daily consumption in terms of packs of cigarettes (or a rough fraction or multiple thereof), but given an opportunity to assign themselves around a modal point they may be psychologically motivated to understate their consumption. The pack-a-day smoker asked whether he smokes more or less than this amount can reconcile the complexities this poses his conscience by believing he smokes a trifle less, rather than a pack or a little more. Our categories, then, for daily consumption were less than five cigarettes; about half a pack; about one pack; about one and a half packs; and about two packs. This was to be answered as of present practice or when last smoking for those who had quit.

Table 3 shows the cigarette smoking pattern for the various study populations. It is immediately apparent that the control population has a larger proportion of nonsmokers than any of the occupational groups.

In considering Table 2 we noted that all the occupational groups except the printers, sheet metal workers, and controls had experienced more lung cancer deaths than might be expected of the California male population. This might be explained, at least in part, by the heavier smoking of the occupational populations.

To determine the over-all relative risk of a population for lung cancer as a result of its smoking practices, it is necessary to have relative risks assigned to various quantities of smoking. Others have developed such relative risks, or they can be computed from various bodies of data.[5-8] Since the quantitative scale of smoking in this study is somewhat different from that used by most American studies, the pooled data were used to develop the relative risk due to cigarette smoking among the study populations. The percentage distribution of the combined study populations by smoking categories, number of lung cancer deaths in each category, and computed relative risks are shown in the tabulation below.

Differences in age distribution of smoking category populations are not taken into account in this computation (men over 55 years have more nonsmokers and fewer heavy smokers). However, such correction only increases the relative risks for heavier smoking categories moderately. For interoccupational comparisons of relative risk from smoking the effect is inconsequential.

The relative risks in the various smoking categories here are somewhat higher than have usually been found from other data. (This is not the re-

Amount of Cigarette Smoking

	None	<5	½ Pack	1 Pack	1½ Packs	2 Packs	Not Stated
Population distribution	21.2	3.8	14.1	41.5	13.5	4.8	1.1
Lung cancers	2	3	12	75	32	13	2
Relative risk*	1	8	9	19	25	29	19

* Let p_0 = percentage of population nonsmokers, and p_5, $p_{\frac{1}{2}}$, p_1, . . . etc., represent the percentages in each of the corresponding smoking categories.

Let C_0 = lung cancer deaths in nonsmokers, and C_5, $C_{\frac{1}{2}}$, C_1, . . . etc., represent lung cancer deaths in each of the corresponding smoking categories.

Relative risk $= C_5/p_5 \div C_0/p_0 = \frac{p_0C_5}{p_5C_0}; \frac{p_0C_{\frac{1}{2}}}{p_{\frac{1}{2}}C_0}; \frac{p_0C_1}{p_1C_0}$; and so forth.

sult of the possible operation of other carcinogenic factors in addition to and independent of smoking in some of these occupational groups; such a factor would actually decrease the gradient.) With unit relative risk based on only two lung cancer deaths among nonsmokers, it is obvious that these determinations are subject to large sampling error. However, as will be shown later, in correcting the lung cancer expectancy of a given population, the population's smoking pattern is a more important variable than is the relative risk smoking gradient.

If the total weighted relative risk is determined for the study groups by multiplying the appropriate percentages of Table 3 with the smoking weighting factors as determined above from the pooled data, and the total weighted relative risk for each population divided by that for the controls, the contribution to relative risk provided by smoking patterns will be as follows:

Controls	1
Welders	1.14
Painters	1.15
Cooks	0.97
Plumbers	1.16
Asbestos workers	1.14
Marine engineers	1.25
Printers	1.05
Sheet metal workers	1.01
Electric bridge crane operators	1.09

As pointed out earlier, the excess of observed lung cancer cases as compared to the expected number might result, in part, from the smaller proportion of nonsmokers in the specific occupational populations as compared to the control population and presumably of the general population of men in California. The observed to expected ratios of Table 2 were divided by the relative risk smoking factors above to obtain the lung cancer relative risks corrected for cigarette smoking in column (6) of Table 2. Only the excess lung cancer deaths for cooks would actually be slightly increased. The excess lung cancer deaths for painters would lose statistical significance with the expected number becoming 27.7 when corrected for smoking pattern of painters ($24.1 \times 1.15 = 27.7$).

This correction for expected lung cancer deaths in the study populations assumes the appropriateness of the lung cancer relative risk assignments for smoking categories; and the smoking pattern of the control study population is representative of that for all men in California. As noted above, the total weighted lung cancer relative risk resulting from the smoking pattern of a population is rather insensitive to the relative risk gradient used. For example, relative risks were adapted from Haenszel and Shimkin[5] as follows: nonsmokers—1; less than a pack—6; one pack—10; more than a pack—13; and not stated—10. Grouping the smoking distributions of Table 3 appropriately and using these relative risks, and again giving the total weighted relative risk of the control population a value of unity, the lung cancer relative risks change little from those last calculated and derived from the weighting factors provided by the pooled data from all study groups. The maximum change was for marine engineers, now 1.21 instead of 1.25. Other changes were limited to differences of 0.01 or 0.02.

Results of two other California studies permit a test of the second assumption, i.e., regarding the smoking pattern of all California males. The first is a study of urban air pollution effects on lung cancer experience of about 70,000 California men, respondents from the California Division of the American Legion. They replied to the same smoking questionnaire as that used for the occupational populations, with results by age groups, and compared to the

controls of the present study, as shown below.

There is obviously good agreement between these two studies of the reported smoking practices, by age groups.

Also, the California Health Survey of 1956, based on household interviews of a probability sample of the California population and including information on smoking practices, showed close agreement in the proportions of nonsmokers with the findings from the air pollution study population and the occupational study controls. The California Health Survey quantified smoking differently from the latter two studies; this makes the comparison of distribution by smoking categories unsatisfactory.

It seems reasonable to say that the cigarette smoking pattern of the occupational controls is more like that of all California men than is that of any of the specific occupational groups with the possible exception of the cooks.

Other Considerations

To summarize the analysis of data at this point, it appears that the occupational groups now under study have some increased frequency of lung cancer deaths. Part of this excess, at least, is apparently the result of the more universal and heavier cigarette consumption by the occupational groups being studied as compared to the control population, and California males generally. After removing the excess attributable to smoking practices, some excess lung cancer mortality persists in most of the study populations.

Several other considerations could affect the results of analysis. The first is the reliability of the age-specific male cancer death rates used for computing the expected lung and other cancer deaths in the study populations. Second, losses could result from failure to identify all cancer deaths that may have occurred in the study populations through oversight during death search, out-of-state migration, etc. And third, is the deficit one would expect (and generally found in other similar prospective studies) in the early period of follow-up of a working population assembled for study because those incapacitated and dying of disease at the time the population was assembled would most likely be missed.

Study Groups

	35–44		45–54		55–64	
	Air Pollution Study	Study Controls	Air Pollution Study	Study Controls	Air Pollution Study	Study Controls
Nonsmokers	26	28	24	25	30	34
Less than one pack	14	16	15	15	17	20
One pack	37	39	37	39	34	31
More than one pack	22	16	22	20	17	14
Amount not stated	1	1	2	1	2	1
Total	100	100	100	100	100	100

The first consideration has already been discussed. We have no way of knowing what proportion of our study populations, and the deaths that may have occurred among them, have been lost by outmigration. A rough estimate from looking at fragments of data indicates that this may not be more than 2 per cent per year. Some of these may become subsequent inmigrants. The loss from oversight on death searching we believe is inconsequential. Independent searches with the same certificates have resulted in near perfect duplication of findings.

To examine the third question, we determined for all cancer deaths in our population whether death had occurred within the first year starting with the date the questionnaire was completed, or after the first year. The population for computation of rates for the first person-year was the number in the occupational study group, and thereafter the total person-years minus the number in the study group. The lung cancers and other cancers found in these two periods in all study groups combined and the corresponding rates are given in Table 4.

Contrary to the findings of other similar prospective studies, there is no evidence of a large deficit of lung cancer and other cancer deaths during the first person-year of follow-up as compared to the period after the first person-year. The population is moving up out of age group 35-44 and up into the age group over 65 years as it ages, causing constantly changing age distribution patterns in these age groups. Age groups 45-54 and 55-64 are best suited, there-

Table 4—Death Rates Per 100,000 for Lung Cancer and Other Cancer During First Person-Year and After First Person-Year for All Study Groups Combined

Age Group	First Person-Year				
	Number	Lung Cancer Deaths	Lung Cancer Rate	Other Cancer Deaths	Other Cancer Rate
35–	27,717	4	14.4	10	36.1
45–	24,478	18	57.2	20	81.7
55–	14,599	20	123.3	39	294.5
65–	—	1*		4*	
Total	66,794	43		73	

Age Group	Person-Years After First				
	Number	Lung Cancer Deaths	Lung Cancer Rate	Other Cancer Deaths	Other Cancer Rate
35–	50,167	1	2.0	18	35.9
45–	61,085	43	60.6	62	101.5
55–	38,222	70	138.7	84	219.8
65–	6,235	15	192.5	22	368.9
Total	155,709	129		186	

* Only men 35-64 are included in study groups. One lung cancer and four other cancer deaths of men 64 when entering the study but dead at age 65 after less than a year are included with deaths of those age 55-64 for first person-year.

fore, for examining this question. For these two age groups there is some increase in the age-specific rates after the first person-year except for other cancer for age group 55-64.

It is not unlikely that some workers sick or ailing at the time they received their questionnaires were disposed to respond since the study was concerned with health aspects of their occupations. This was evidenced by a number of death records within the first month following completion of the questionnaires. An extreme example is one printer's questionnaire (which was eliminated) submitted subsequent to his recent death by his widow. Lung cancer deaths occurring during the first person-year were scattered fairly evenly over the 12 months following response. Deaths from other cancers were somewhat more frequent in the middle and later months of the first person-year than in the earlier months.

Earlier it was pointed out in Table 2 that all study groups combined showed a 15 per cent deficit of other cancer deaths (Observed/Expected=0.85). The possible sources of deficit that have been examined make it seem likely that this may be an adequate approximation of what the deficit may prove to be. Using this as a measure of the probable deficit in lung cancer deaths as well, we can arrive at some revised estimates of the observed and expected lung cancer deaths in the various occupational study groups. In the following table, the observed lung cancer deaths of Table 2 have been increased to eliminate the estimated deficit by dividing each by 0.85. The expected lung cancer deaths are corrected for smoking practice by multiplying the expected number for each occupational group in Table 2 by the smoking factor as determined for that occupation. (Thus, expected lung cancer deaths for welders are $16.9 \times 1.14 = 19.3$; for painters—$24.1 \times 1.15 = 27.7$; for cooks—$16.8 \times 0.97 = 16.3$; etc.) The resulting observed over expected ratio will then be as shown.

Occupational Group	Lung Cancer		Ratio Observed/ Expected
	Observed	Expected	
Welders	22	19.3	1.14
Painters	41	27.7	1.48
Cooks	27	16.3	1.66
Asbestos workers	22	15.6	1.41
Printers	2	8.1	0.25
Marine engineers	6	4.6	1.30
Electric bridge crane operators	–	0.54	–
Plumbers	19	15.0	1.27
Sheet metal workers	4	6.3	0.63
Controls	20	19.8	1.01

Under these conditions the painters and cooks would have significant excesses of lung cancer.

Discussion

The analysis of the data from this study is far from definite at this time. Perhaps not until the 1960 Census data make possible the computation of age-specific cancer mortality rates for the intercensal years in California will the final analysis be possible. Also this will allow time for all the study populations to accumulate five years of mortality experience.

It is clear that over-all increased relative risks, such as lung cancer in certain occupations being investigated here, can be misleading when a powerful and almost universally acting factor is operating. Cigarette smoking is one such factor in lung cancer. The identification of a second variable positively associated with lung cancer but independent of smoking becomes difficult.[9] This swamping effect was well demonstrated by Stocks and Campbell.[10] They found that a ninefold increased risk for lung cancer among urban nonsmokers as compared to rural nonsmokers all but disappeared when urban-rural comparisons were made between heavy smokers.

To illustrate the point, let us assume that we have a population of 100,000 men among whom 30 per cent are nonsmokers (Table 5). Assume also that the lung cancer rate for nonsmokers is ten per 100,000 and for all categories of smokers together it is ten times greater, or 100 per 100,000. In such a population of men, then, the annual lung cancer rate will be 73 per 100,000 $\left(\frac{10 \times 30{,}000}{100{,}000} + \frac{100 \times 70{,}000}{100{,}000}\right)$.

Assume now we have a second population of men that is identical to the first except the men in the second population are exposed to a pulmonary carcinogen that acts independently from tobacco usage; and assume that the lung cancer rate for the second population is 110 per 100,000 (1.5 times that of the first population). The excess of 37 cases per 100,000 over the rate for the first population (110 − 73) is independent of tobacco use and would be found in smokers and nonsmokers with equal frequency. We would expect the lung cancer rate among nonsmokers in the second population would be 47 per 100,000 (10 + 37) and 137 among smokers (100 + 37). The relative risks between the two populations for nonsmokers, then, would be 47/10 or 4.7 and 137/100 or 1.4 for smokers.

Table 5—Illustration of Possible Masking Effect of Smoking Factor for Independently Acting Occupational Lung Cancer Hazard:

Smoking Category (1)	Population (2)	Lung Cancer Death Rate Per 100,000 General Population (3)	Lung Cancer Death Rate Per 100,000 From Occupational Factor (4)	Total* Lung Cancer Death Rate (5)	Relative Risk (5) ÷ (3)
Where Occupational Factor Increases Lung Cancer Rate 1.5 Over That of General Population					
Nonsmokers	30,000	10	37	47	4.7
Smokers	70,000	100	37	137	1.4
All categories	100,000	73	37	110	1.5
Where Occupational Factor Increases Lung Cancer Rate Twofold					
Nonsmokers	30,000	10	73	83	8.3
Smokers	70,000	100	73	173	1.7
All categories	100,000	73	73	146	2.0
Where Occupational Factor Increases Lung Cancer Risk Twofold in Absence of Smoking					
Nonsmokers	30,000	10	10	20	2.0
Smokers	70,000	100	10	110	1.1
All categories	100,000	73	10	83	1.1 (4)

* These examples neglect the instances where the same individual would develop lung cancer from either of two independent causes. The rates as shown would not be changed by this correction.

In a similar manner, if a population engaged in an occupation has twice the rate of lung cancer than would be expected from general population experience, this may actually represent an eightfold increased risk if it could be examined in the absence of the effect of the smoking factor.

The final illustration is concerned with an occupational factor that would double the risk of lung cancer if there were no smoking factor operating. The doubling effect would only be evident among nonsmokers, and for the whole occupational population this hazard would be difficult to identify since it would increase the lung cancer risk only 14 per cent (Table 5, $83 \div 73 = 1.14$).

If it turns out that some of the occupations being studied do show a significant excess of lung cancer in the range of 1.5- to 2-fold, it is of interest to realize that this could represent a carcinogenic factor of considerable importance in its own right. The converse of this must also be kept in mind as a possibility, with occupational exposure enhancing the effect of smoking.

Summary

A case-control study of lung cancer cases and matched controls disclosed a number of occupations to have an apparently increased risk of lung cancer. To examine these possibilities further a prospective study is now under way. Populations of men engaged in these and other specific occupations, including a group serving as a control population, were assembled and we are now following their lung cancer experience by searching these populations for matches with all male lung cancer deaths of California residents.

Only a preliminary analysis is possible at this time because of uncertain postcensal age-specific cancer mortality rates and the need for additional follow-up time—at least five years. Consideration of sources of deficit of cancer deaths in the study populations indicates the 15 per cent deficit calculated for deaths other than lung cancer to be an adequate approximation.

Most of the study occupations have a larger proportion of cigarette smokers and heavier consumption than is true for the control population. The latter appear to be quite representative of California males generally in respect to cigarette smoking. Relative risks for each occupation as compared to the control population are computed, considering the smoking distribution of the controls as representing unit relative risk.

Correcting the observed lung cancer deaths for the apparent deficit in our study conditions and the expected lung cancer deaths for smoking practice leaves at least two occupations with tentative excesses of lung cancer risk. These are cooks and painters.

The order of magnitude of over-all increased lung cancer risk we can expect in these populations now appears in the 1.5-fold to 2-fold range. This would represent an increased risk from the occupational exposure in the range of 5- to 9-fold for nonsmokers, if the occupation's factor were acting independently from the smoking factor.

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Honors to Canadian Health Workers

At its 51st Annual Meeting, held this year in Halifax, the Canadian Public Health Association honored three public health leaders with Honorary Memberships for outstanding and devoted service over the years. CPHA has been making these awards since 1933. This year the honors went to Russell Johnson Collins, B.A., M.A., M.D., a pioneer leader in tuberculosis control in the Maritimes; to Mona Gordon Wilson, O.B.E., R.N., who as a public health nurse laid the foundations of the provincial health services in Prince Edward Island; and to Eunice Henrietta Dyke, Reg. N., another leader in public health nursing who in 1914 began the development of the generalized public health nursing service in the Department of Health, City of Toronto.

What light can experimental carcinogenesis throw on the problem of food additives and possible carcinogens among them? Although no answer is provided, this article indicates the complexities of the problem and stresses certain essential points that must be considered in order to arrive at any rational decisions.

EXPERIMENTAL CARCINOGENESIS AND THE PROBLEM OF FOOD ADDITIVES

Robert E. Eckardt, M.D., Ph.D.

WITH THE passage last year of the Food and Drug Law Amendments (Public Law 85-929) there now falls upon the public health official the responsibility of administering this law intelligently. One of the provisions of this law reads "that no additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal, or if it is found, after tests which are appropriate for the evaluation of the safety of food additives, to induce cancer in man or animal." It is this phrase which has, perhaps, caused the greatest agitation throughout the country since it is not known precisely how this phrase will be interpreted and administered. The intent of the law, it seems to me, is to exclude from our food supply those materials which may present a cancer hazard to human beings when ingested in their diet. It is essential, I believe, for this phrase to be administered with intelligence, wisdom, and knowledge or unnecessary public anxieties may be created, or the public exposed to unnecessary hazards. The public health officer should stand ready to prevent either of these. Because this phrase alludes to carcinogenesis in animals, it behooves the public health officer to acquaint himself with this field, and to recognize some of the inconsistencies, limitations, and drawbacks.

When Yamagiwa and Ichikawa[1] in 1915 first produced tumors and cancers by painting coal tar repetitively on the ears of rabbits, many people believed that this discovery would open a new era, much as the discovery of bacteria had done for infectious diseases. This hope seemed to have been confirmed when Tsutsui[2] three years later produced cancers in mice by painting coal tar. When the brilliant chemical work of Cook, Hewett, and Hieger[3] succeeded in isolating 3, 4-benzpyrene as the active agent from coal tar by a combination of these biological methods and chemical methods guided by fluorescence spectroscopy, still another piece seemed to fit into the jig-saw puzzle of cancer causation. At this stage, it seemed that all man had to do to avoid carcinogens was to test an unknown material on mice, chemically separate the active agent using fluorescence spectroscopy, and then devise methods to avoid exposure to the material or remove the

active agent. Unfortunately, there are many people today who have not followed closely the developments in the field of carcinogenesis who believe things remain this simple. For instance, it is often suggested that any material which fluoresces in ultraviolet light is suspect as a carcinogen. However, it should be remembered that many noncarcinogenic materials fluoresce and, further, that fluorescence can be quenched by a variety of means.

Turning to the biological field, it should be remembered that not all species will respond in the same way to the same material. Thus in some experiments performed for us several years ago, mice, rats, rabbits, guinea pigs, and monkeys were all painted with the same material three times a week. Rats and guinea pigs developed nothing at all when painted throughout their life span. After several months, rabbits began to develop small tumors at the site of painting. With continued painting, these tumors increased in size and number, but very few of them became malignant. Mice developed small papillomas in about 40 days and with continued painting, many of these became malignant before 150 days. Monkeys developed small papillomas after about a year of painting. After eight years of painting, one of these animals had a tumor that had all the gross characteristics of a malignancy. Microscopically it also looked like a malignancy, yet it did not metastasize, grew in size very slowly, and had few of the biological characteristics of malignancy, even though morphologically it looked like cancer. The results of these tests quite properly raise the question of which result, if any, is appropriate for the evaluation of the safety of food additives. Yet today there are those who state unequivocally that skin painting in mice is an appropriate test for materials which are ingested or inhaled ignoring the results in other species. Quite frankly, I must say, I do not know the answer to this important question. I am prepared to accept skin painting tests in mice as a guide to the probable activity of the same material on the skin of the human being, but to extend this unhesitantly to the lungs or gastrointestinal tract at this time seems inappropriate.

In the experiments outlined above the mice were housed ten in a cage, and it was observed that after the application of the oil, they diligently set to work licking each other off in an attempt to remove the oil and clean themselves up. Several thousand mice were painted in these experiments and all animals were subjected to gross autopsy. Even though the presence of large quantities of the oil in the gastrointestinal tract was verified with an ultraviolet light, only two gastrointestinal tract tumors were observed (well within the normal incidence for this species) and no abnormal incidence of other tumors was observed. I do not wish to be misunderstood. I am not advocating the incorporation of this oil in our diet. I wish only to point out that here was a material highly carcinogenic to the mouse skin, yet it produced no other tumors when ingested by mice. How much more difficult is the problem when the material under test produces only one or two tumors of the skin of the mouse.

Turning to the subcutaneous tissues, the Oppenheimers[4] have produced sarcomas by implanting sheets of various plastics under the skin of rats and mice. There are those, therefore, who have stated as a result of these experiments, that these plastics are carcinogenic. Yet if the same plastic sheet has small holes punched in it, or is ground into a powder before insertion, no sarcomas result. Is it, then, really the plastic that is carcinogenic, or is it the physical state of the material which is important? The observations of these investigators have shown that a fibrous

pocket forms around the plastic sheet. If the plastic is removed from the pocket before a critical period (roughly six months), sarcomas do not develop; however, if it is removed after this time, even though the pocket shows no evidence of malignant change at the time of removal of the film, sarcomas will develop. It seems to me that these results might suggest caution to the surgeon who considers implanting plastic sheets subcutaneously in the human as a structural support, but they apparently have no significance for the area of food additives.

Further, it has been observed that sugar and cholesterol when injected subcutaneously into rats and/or mice will produce sarcomas. Does this mean that these materials are carcinogenic in appropriate tests and should be excluded from the food supply? On the contrary, I believe that these results simply suggest that the subcutaneous tissues are highly inappropriate as test sites for evaluating the safety of food additives. Thus when someone says a material is "carcinogenic," it is essential to inquire in what species and by what type of test, if any practical implications are to be drawn from the observations. It is not enough to say, as the American Cancer Society states, that they are opposed to the incorporation of carcinogens in the food supply. This is like being opposed to sin. But, like sin, a carcinogen needs a definition. One academic definition that has been proposed is that a carcinogen is any material which produces a tumor at any dosage in any species by any route of administration. With such a definition of a carcinogen, Public Law 85-929 becomes impossible to administer.

When polyaromatic hydrocarbons which produce a profusion of tumors of the skin when painted on mice are fed to this species, they produce cancer of the forestomach but nothing else.[5] It should be remembered that the forestomach of the mouse is lined with squamous epithelium, not glandular epithelium as in human beings, so that these experiments can be considered as an extension of the skin painting experiments. There are two types of compounds that will produce tumors in experimental animals when fed. Certain amino-azo compounds when fed to rats will result in liver tumors.[6] However, there appears to be no counterpart to these experiments in human beings. Besides, to produce large numbers of such tumors it is necessary to feed low protein or riboflavin deficient diets. Adequate protein or riboflavin in the diet produces a remarkable protection. Also, surprisingly, 0.003 per cent of methyl cholanthrene (Miller), a potent skin carcinogen will protect against such tumors. Finally, mice are much less susceptible, and rabbits, squirrels, chickens, guinea pigs, hamsters, and chipmunks not susceptible at all. Although much research effort has been devoted to a study of these tumors and the variations in chemical structure which will produce them, or not, as the case may be, they probably have no practical significance.

Certain amino compounds, such as β-naphthylamine or benzidine, when fed to dogs will produce bladder tumors.[7] These tumors are of importance to human beings because it is known that β-naphthylamine and probably benzidine, too, will cause bladder tumors in workers exposed to them in their occupation. As shown by the work of Bonser,[8] men and dogs develop bladder tumors from β-naphthylamine because they can metabolize it to 2-amino-1-naphthol. Mice, on the other hand, do not have the ability to metabolize β-naphthylamine to 2-amino-1-naphthol, and hence do not develop bladder tumors unless the metabolite, the 2-amino-1-naphthol is implanted surgically in pellets directly into the bladder. These experiments suggest that it would

be highly advantageous for us to develop some understanding of the metabolic pathways involved with various chemicals that induce tumors and cancers in various species of animals because if similar metabolic pathways are not present in human beings, the likelihood of this compound being carcinogenic to man is probably quite remote.

Often cited as an example of the necessity of testing materials for their carcinogenicity is 2-acetylaminofluorene. This compound was developed as an insecticide. Early in the biological testing program it became apparent that this compound produced a profusion of tumors at multiple sites in a variety of animals. The compound was, therefore, never used in its intended application. Here it was easy to decide that the compound should not be used where it might contaminate the food supply. I do not believe that it requires very profound thinking to reach this decision. Suppose, however, that this compound had produced an occasional tumor at one site, in one or two species of animals? What then should be the proper decision concerning it?

It is not my purpose to provide the answer to that question—for the simple reason that I do not know it. There are no magic formulas, no crystal balls, or simple manipulations of a slide rule that will permit the public health official to say whether a given compound will present a cancer hazard to the general public if it is permitted to enter the food supply. Life would be very simple for us all if there were such a magic formula. Decisions on such questions will have to be reached after weighing all available evidence for and against the compound under consideration. First, what is the nature of the compound—that is, is it water soluble or water insoluble, a large molecule or a small molecule? Second, what is the probable concentration in the food supply? Will it be present in large, easily detectable amounts or will it be present in infinitesimally small quantities which only the most sensitive and elaborate chemical technics will detect? Remember that 3,4-benzpyrene is probably present in our drinking water at concentrations of one part per billion. It has been suggested that the stomach cancer rate in England is higher than in the United States because soot-laden air is permitted to contact the unwrapped food in England, but is excluded from doing so in the United States by the almost universal practice here of wrapping our food.[9] Third, what is known of the biological effects of the compound? Does it produce many tumors of appropriate sites in several species of animals, or does it produce only occasional tumors of unusual sites in rare species, and then only at the direct site of application? Fourth, what do we know about metabolic pathways in animals as compared with man? Are they similar or quite different? Finally, and perhaps just as important, what place in food technology does the compound fulfill? Does it accomplish an important sanitary or preservative function which permits more food of good quality to be brought to more people at a reduced cost? Or does it only add some frill with which one can dispense.

These are the questions which must be answered before this law can be adequately administered. Because there is so much emotion associated with the word "cancer" today, people are likely to be panicked into hasty emotional decisions where carcinogens are concerned. A review of experimental carcinogenesis shows that this technic does not answer all our questions. In fact, it has probably raised more questions than it has answered in every field but occupational cancer, where it has been of great use to the industrial physician in helping him pin point exposures and then to design economic controls. In

the field of food additives, however, experimental carcinogenesis is in its infancy. Much more basic, fundamental research needs to be undertaken. There is no one test or battery of tests of carcinogenicity which are appropriate for the evaluation of the safety of food additives. Rather, each compound must be evaluated with judgment and wisdom from the five points previously outlined. For emphasis they are repeated here:

1. What is the chemical nature of the compound?

2. What is the probable concentration in the food supply?

3. What are the known biological effects in animals, i.e., many tumors in many species, or few tumors in an occasional animal?

4. What are the metabolic pathways in man and animals?

5. How important a role does it play in our food technology?

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In studying the role of a university clinic in the medical care of a largely rural area, where the clinic has chiefly a consultative function, attention was devoted to physicians' reasons for referral to this facility. This report describes these reasons and deals with some of the factors which affect the referral process.

PATIENT REFERRAL TO A UNIVERSITY CLINIC: PATTERNS IN A RURAL STATE

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THE ROLE of the university clinic in the medical care of its surrounding area is largely unexamined; this is particularly true of university clinics located in predominantly rural states. In such areas, regular medical care is of necessity provided by the local physician; the university clinic would be expected primarily to provide consultation for the physician or health agency in outlying communities rather than to give continuous care for a large group of patients as may occur in urban communities.

In the rural setting, therefore, the processes by which patients are referred and get to the university clinic are primary determinants of the role it can play in the medical care of the area. Clinical teaching as well as genetic, epidemiological, and other forms of research at the university center are similarly affected by the patterns of patient referral.

The present report is a preliminary description of this process of referral and of certain variables which affect it, as studied in the General Clinic of the North Carolina Memorial Hospital (NCMH), associated with the School of Medicine of the University of North Carolina. This clinic serves as a comprehensive diagnostic and consultant center for ambulatory patients referred from the eastern two-thirds of North Carolina.[1] The consultant role has been strongly emphasized in the clinic and throughout NCMH from the time of their opening in 1952. Except in emergencies, patients are accepted only on referral by a physician or agency. Each patient in the General Clinic receives a thorough work-up by a senior medical student or house officer under staff supervision, is seen several times on return visits until his problem is clarified and a therapeutic regimen established, and is then returned to the care of his referring physician. The records of the clinic are examined weekly and are not considered complete until a summary letter has been sent to the referring physician. Only a few patients are followed for prolonged periods in two small demonstration teaching programs and in areas of special interest to members of the staff. It is in such a consultation-oriented setting that the natural history of the referral process is being examined.

Table 1—Number of Physicians in Study Area—By Strata (Figures in Each Cell are in Order from Top to Bottom: Population of Physicians, Predicted Sample Size, and Number Interviewed. Blank Cells Are Empty)

No. of Referrals in 1956	Age of M.D.	WHITE GENERAL PRACTITIONERS						WHITE SPECIALISTS						Negro M.D.'s
		Pop. under 25,000			Pop. over 25,000			Pop. under 25,000			Pop. over 25,000			
		<25 Mi.	25-99	100+	<25 Mi.	25-99	100+	<25 Mi.	25-99	100+	<25 Mi.	25-99	100+	
0	<40	6 1 1	74 5 5	35 4 4	12 1 1	23 1 1		36 2 2		27 2 2	23 1 1	43 3 3	43 3 3	19 1 1
	40-59		66 4 4	58 4 4		17 1 1			80 5 5	64 4 4		113 7 7		33 2 2
	60+		67 4 4	51 3 3		27 2 2		37 2 2		20 1 1		41 3 3		35 2 2
1-2	<40	6 2 2	30 10 12	12 4 5		2 1 0			5 2 0	5 2 1	3 1 0	8 3 3	2 1 1	5 2 2
	40-59		31 10 10	14 5 1		8 3 0			22 7 5	13 4 5		9 3 2		10 3 2
	60+		13 4 1					10 3 1				2 1 0		3 1 0
3+	<40	2 1 1	24 8 9	5 2 1		4 1 1		9 3 3						
	40-59	3 1 1	18 6 6						7 2 2					5 2 2
	60+		5 2 2											2 1 1

Methods

A. Design of Sample and Interviews

The development of the methodology for this study is the subject of a previous publication.[2] In brief, the study involved interviews of a sample of physicians and of the patients they referred, and examination of relevant material in the patients' medical records. A stratified random sample of physicians was selected from the eastern two-thirds of North Carolina, an area which includes 90 per cent of physicians referring patients to the General Clinic and 95 per cent of the physician-referred patients. The population of physicians in the study area was classified by several variables for the reference period (the year 1956) and is shown in Table 1. A 33 per cent sample of physicians who had referred patients and a 6.5 per cent sample of physicians who had not referred patients to the clinic in 1956 were selected at random within the various strata. Interviews with physicians who had referred patients in 1956 were conducted after they referred one or more patients during the study period (August 1, 1957-February 28, 1959), and included questions about a specific "key" patient whom they had recently referred.

The sample of patients was based upon the sample of physicians: One "key" patient was included for each referring physician and additional patients referred by frequently-referring physicians were also interviewed. Other sources of referral were also sampled;[2] however, they will not be discussed in this report.

Physicians were interviewed, in most instances in their offices, by one of the three physicians of the research team. A focused, nondirective, semistructured

interview was used and answers were recorded on a form in the order given. Patients were interviewed by a medical social worker and a cultural anthropologist, using a similar technic. A brief preliminary interview with each patient was held at his initial visit to the clinic; the principal interview was conducted at the patient's home from four to eight weeks later.

B. Results of Sampling

The study period during which patients and their referral sources were accepted into the sample lasted 19 months. The numbers of physicians and physician-referred patients accepted into the sample and interviewed are shown in Tables 1 and 2. The cells for which the number interviewed did not come up to the expected sample size occurred entirely among the physicians who had referred one or two patients to the clinic in 1956. Because of the slow rate of referral from these physicians, noted early in the study period, the method by which the interview process was initiated was altered[2] to increase the rate of appearance in the sample of patients from these infrequently-referring physicians. Even with this change, the number of physicians of this category included in the study was 19 short of the expected number when the field work had to be terminated for practical considerations of time.

In discussing this apparently irregular and unpredictable referral performance by the physicians who refer infrequently, it was suggested previously[2] that the irregularity might be due to a greater influence by the patients themselves on the initiation of referral than was anticipated, a conclusion that is borne out strongly in the evidence presented below. That the lack of appearance of patients from these particular physicians is not a result of any general trend toward decreased utilization of the clinic is indicated by figures of steady growth in the total number of patients seen in the Outpatient Department as a whole (11 per cent per year), and in new patients seen in the Screening and General Clinics specifically (4 per cent per year) throughout this period.

The incidence of refusal to be interviewed was very low. Despite many attempts, one physician would never agree to set a time for an interview. One other physician, frequently hospitalized with a chronic illness, was too ill to be interviewed. These physicians were replaced in the sample, as were physicians found to have moved out of the area, to have stopped practice or

Table 2—Population of Physicians in Study Area in the Reference Year (1956); Sample Size Expected; and Sample Interviewed in Study Period (August 1, 1957, Through February 28, 1959)

Number of Referrals to Clinic in 1956	Physicians			Patients	
	Population in Referral Area	Sample Size Expected	Sample Interviewed	Minimum Sample Expected	Sample Interviewed
None	1,068	68	68	0	4
1-2	213	72	53	72	75
3+	84	29	29	58	46
	1,365	169	150	130	125

to have died. Four patients would not agree to a home interview; in one of these instances the patient's wife was interviewed at home.

C. Analysis of Data

A preliminary categorization of answers obtained during the pretest interviews was carried out. Approximately 50 of the study-period interviews with physicians and 50 interviews with patients were examined in terms of the original categories. These categories were revised slightly, and codes for the answers to each question established. The coding instructions for the two questions of the physician interview discussed in the present paper are contained in the Appendix.

The answers from the physician interviews were coded independently by the three physicians of the research team, the codings compared with each other, and differences resolved by mutual agreement. For the questions included in this report, few differences in initial coding by the three physicians occurred; most of the verbatim answers about reasons for referral fitted directly into the categories. The same procedure was followed by the two social scientists in arriving at a final code for the answers to the patient interviews.

The classification of physicians as general practitioners or specialists, based originally on data from the American Medical Directory and the Roster of Fellows of the Medical Society of the state of North Carolina, was reconsidered in the light of the physicians' statements at the time of interview. Each physician was reclassified as general practitioner, specialist, or as having a mixed type of practice; this final classification is used in the tables. By this reclassification, seven physicians originally considered specialists were reclassified as general practitioners (almost entirely because the American Medical Directory lists physicians' stated areas of special interests, e.g., obstetrics or pediatrics, but does not differentiate these from an actual specialized form of practice), and seven specialists and four general practitioners were reclassified as having a mixed type of practice, usually general practice with some surgery.

Patterns of Referral to a Medical Center

A. Physicians' General Reasons for Referral to a Medical Center, Compared with Reasons for Referral of Specific Patients

The questions asked of physicians about reasons for referral to a medical center dealt first with their general views about referral, i.e., "Why do you refer patients to a medical center?," followed in the instances in which the physician had recently referred a "key" patient to the clinic by the question, "Why did you refer the key patient?" The last column of Table 3 presents the first answers of all physicians to the general question. The type of reason most frequently given was, "Help with diagnosis and treatment," stated in those words or in closely related, nonspecific terms (see Appendix). Other frequent answers were "Inadequacy of local facilities" and referral "for more specialized diagnosis or treatment."

The various reasons for referral to a medical center given by physicians have been grouped in Table 3 under three headings: (A) referrals initiated by the physician for rather specific reasons; (B) referrals initiated by the physician for nonspecific reasons; and (C) referrals initiated primarily by the patient or for economic reasons. These groups may be described in more detail.

In Group A, physician-initiated referrals for specific reasons, are included those reasons which indicate that the referring physician has to some degree delineated the patient's problem and has some specific purpose in mind in

seeking consultation: He has identified the problem to the extent of knowing that it is outside the limits of his practice, or beyond his competency, or beyond the capabilities of local facilities; perhaps he has narrowed the diagnostic or therapeutic possibilities to one special area of medicine. Referral to a medical center because a patient presents an instructive teaching problem—a reason rarely given—is also included in this group.

In Group B, physician-initiated referral for nonspecific reasons, are placed the answers which indicate that the physician is seeking professional consultation at a medical center about a patient who presents a problem to him, but the type of problem and the type of help needed are not specified. The patient is referred, "For help in diagnosis and treatment," or "For a complete check-up," or, "To reassure the physician that he is right," or, "Because the patient may be seen there by many specialists at one place"—

Table 3—First Answer by All Physicians to the Question, "Why Do You Refer Patients to a Medical Center?"

Answers	General Practitioners	Specialists	Mixed Type of Practice	All Groups
A. Physician-initiated referrals for specific reasons:				
a. Problems outside voluntary limits of his practice	4	2	0	6
b. Problems beyond his competency but in his field	2	8	1	11
c. For more specialized diagnosis and treatment	6	10	2	18
d. Inadequate local facilities	12	6	3	21
e. Patients with instructive teaching problems	3	2	0	5
Total for A.	27 (27%)	28 (68%)	6	61 (41%)
B. Physician-initiated referrals for nonspecific reasons:				
a. For diagnosis and treatment, no specifications	48	9	3	60
b. Unified clinical facilities	12	0	0	12
Total for B.	60 (61%)	9 (22%)	3	72 (48%)
C. Referrals initiated primarily by patients:				
a. Direct request of patient or family	8	1	1	10
b. Apparent loss of rapport between physician and patient	1	2	1	4
c. Medically indigent patients	2	1	0	3
Total for C.	11 (11%)	4 (10%)	2	17 (11%)
Totals	98 (100%)	41 (100%)	11	150 (100%)

to list some of the typical answers which have been included in this group; also see the Appendix.

Reasons included in Group C, "Referrals initiated primarily by the patient," appear to be a group distinctly different from the two previously described. In most instances, the patient has asked the physician directly to be referred to the medical center; less frequently, the patient indicates to the physician that some of his questions about his health are unanswered, in such a way that the physician recognizes either an impending or an overt loss of rapport and makes the referral, "To reassure the patient." The rare referrals because of medical indigency of the patient have also been placed in this group.

No value judgments can be made on the basis of these groups of reasons alone about the appropriateness of the reasons themselves, either medically or socially. Depending upon circumstances, each could be a sound reason for referring a patient; for example, if the physician or patient senses a lack of confidence between the two, then it would certainly seem to be in the best interests of the patient that he be referred to some other physician or to a medical center.

The first answer which physicians gave for referring patients were also classified by the type of practice of the physician; the results, shown in Table 3, are discussed in a later section.

Inasmuch as physicians usually gave several answers when asked their general reasons for referral, an arbitrary system of weighting these multiple answers was selected. It was based upon the order in which the answers were given by the physicians. The first answer was given a weight of "5," the second "4," and so forth, down to "1" for his fifth answer. It is thought that the first answers given may represent the more frequently occurring reason in the physician's experience and the later answers, less frequently occurring reasons. Thus, this weighting scheme might give a better reflection of the over-all frequency of reasons for referral among the physician population as a whole than would first answers alone. However, it is recognized that other factors could and probably do affect the order of answers given; i.e., first answers may tend to be "acceptable" answers and later answers may be the real reason for referral.

Table 4, last column, presents the totals of the weighted scores for each answer to the general question about referral. It is noteworthy that the weighted scores for referral initiated primarily by patients (Group C), 30 per cent, are considerably higher than the 11 per cent found for first answers alone. This result suggests that, although physicians do not often view a disturbance in their relationship with patients as the first of their general reasons for referral to a medical center, they do recognize its presence among their reasons to a substantial degree. This shift to Group C is based upon the arbitrary scheme of weighting the order of answers. However, if this scheme is wrong, or in reverse direction of what the weights should be, then the trend to Group C answers would be still more pronounced.

To obtain a more direct measure of the reasons for referral as actually practiced, each referring physician was next asked why he had referred the "key" patient to this medical center. The key patient's views of the reason he was referred, and who initiated the referral, were also obtained.

Table 5 presents the answers to the question, "Why did you refer the key patient?," given by 84 of the 85 physicians in the sample who, by the design of the study, had a key patient. The 85th physician could not recall why he

had referred the specific patient. The answers are recorded in three ways. The first column of Table 5 gives the first answer of the physician to this question. The nonspecific reason, "For diagnosis and treatment," is the answer most frequently given. However, the second most frequent answer has now become, "At the request of the patient or his family." When these first answers are grouped into the three descriptive groups defined above, Group C, referrals initiated primarily by patients or because of diminished rapport, is the largest and accounts for 42 per cent of the total.

The second column in Table 5 presents the weighted scores of all answers to this question by physicians.* It can be seen that the weighted scores in this

* Inasmuch as no more than three answers were ever given to this question, the weights assigned were three, two, and one, respectively, for first, second, and third answers.

Table 4—Responses of All Physicians, Weighted for Multiple Answers, to the Question, "Why Do You Refer Patients to a Medical Center?"

Answers	General Practitioners Score*	Specialists Score	Mixed Type of Practice Score	All Groups Score
A. Physician-initiated referrals for specific reasons:				
a. Problems outside voluntary limits of his practice	27	14	0	41
b. Problems beyond his competency but in his field	43	63	5	111
c. For more specialized diagnosis and treatment	64	88	14	166
d. Inadequate local facilities	178	84	23	285
e. Patients with instructive teaching problems	85	27	19	131
Total for A.	397 (30%)	276 (53%)	61 (40%)	734 (37%)
B. Physician-initiated referrals for nonspecific reasons:				
a. For diagnosis and treatment, no specifications	340	74	30	444
b. Unified clinical facilities	189	24	15	228
Total for B.	529 (40%)	98 (19%)	45 (29%)	672 (34%)
C. Referrals initiated primarily by patients:				
a. Direct request of patient or family	200	66	20	286
b. Apparent loss of rapport between physician and patient	154	66	18	238
c. Medically indigent patients	42	16	9	67
Total for C.	396 (30%)	148 (28%)	47 (31%)	591 (29%)
Totals	1,322 (100%)	522 (100%)	153 (100%)	1,997 (100%)

* Physicians' multiple answers were weighted in the order in which they gave them: "5" for first answer, "4" for second answer, etc. Scores represent the total weighted value for each category.

Table 5—Answers by Referring Physicians to the Question, "Why Was the Key Patient Referred?"

Answers	First Answers by Physicians	Weighted Answers by Physicians*	First Answers by Physicians Revised in the Light of Patients' Statements†
A. Physician-initiated referrals for specific reasons:			
a. Problems outside voluntary limits of his practice	1	5	
b. Problems beyond his competency but in his field	3	18	
c. For more specialized diagnosis and treatment	15	67	
d. Inadequate local facilities	1	16	
e. Patients with instructive teaching problems	0	2	
Total for A.	20 (24%)	108 (29%)	18 (21%)
B. Physician-initiated referrals for nonspecific reasons:			
a. For diagnosis and treatment, no specifications	29	108	
b. Unified clinical facilities	0	3	
Total for B.	29 (34%)	111 (30%)	23 (27%)
C. Referrals initiated primarily by patients:			
a. Direct request of patient or family	21	71	
b. Apparent loss of rapport between physician and patient	11	22	
c. Medically indigent patients	3	55	
Total for C.	35 (42%)	148 (40%)	43 (51%)
Grand Total	84 (100%)	367 (100%)	84 (100%)

* Answers weighted as in Table 4 except that first answer was given weight of "3," second "2," etc.

† When patients stated specifically that they had asked the physician to refer them (although physicians had not indicated this), such instances were changed from the original categories to Group C.

table compare well with the first answers given.

The third column in Table 5 presents the classification of first answers given by physicians, as altered by the instances in which the key patients stated that they rather than the physician had initiated the referral. In 18 of the 20 instances in Group A, the patient confirmed what the physician had replied. In the other two instances, the patient specifically stated that he had initiated the referral himself and this number was transferred to Group C. Of the 29 replies in Group B (based on physicians' answers), six patients stated that they had asked the physician to refer them to the clinic and these were similarly transferred to Group C. These transfers, added to the 35 instances already classified as primarily patient-initiated referrals in the physicians' views, gives a total of 43 instances in this category.*

The third column in Table 5 indicates that among a representative sample of patients nominally referred by physicians to the General Clinic of this medical center, slightly more than half of them were considered by either the physician, or patient, or both to be patient-initiated referrals. As stated before, no value judgments can be made about the soundness of this reason for referral. However, referral on this basis, largely beyond the control of physicians, appears to be an important factor in determining the way in which a medical center is utilized in providing medical care to its surrounding area and in providing teaching for medical personnel of all types.

Until studies comparable to the present one are made in other consultant settings, one can only speculate about the applicability of these findings beyond this clinic. Inasmuch as this clinic probably emphasizes more strongly than most the consultant role of the clinic and the necessity for having a referring physician, it seems likely that other referral centers have at least as large a proportion of patients who refer themselves via their local physicians.

B. Variables Among Physicians Which Affect Reasons for Referral to a Medical Center

(1) Type of Practice—It might be expected that the nature of specialization itself would lead specialists to refer patients for specific reasons (Group A) more often than general practitioners. On the other hand, there are no obvious grounds for expecting any difference between specialists and general practitioners in referrals that are patient-initiated. As shown in Tables 3 and 4, the general reasons for referral given by specialists and general practitioners appear to bear out these expectations. Sixty-eight per cent of specialists gave a specific reason (Group A) as first answer, compared to only 27 per cent of general practitioners, with converse figures for nonspecific reasons (Group B). These differences were statistically significant ($P<0.01$).† The same differences are noted when weighted scores are considered (Table 4). There are no differences by type of practice in the frequency of Group C reasons.

However, when the reasons for referral of key patients are considered among the specialist group a change has apparently occurred in the frequency with which referral is made for specific, Group A, reasons. Whereas 68 per cent of the specialists' first answers to the general question were classified in this group, Table 6 shows

* There were 11 instances in which the physician considered the referral primarily patient-initiated, whereas the patient thought the physician had initiated the referral. These have not been removed from Group C in Table 5 because, in the opinion of at least one person involved (the physician), the patient had indicated his desire to be referred elsewhere.

† Except where otherwise noted, tests of statistical significance have been made by the Chi-Square Test.

Table 6—Answers by Referring Physicians to the Question, "Why Was the Key Patient Referred?" Compared with Type of Practice

First Answers by Referring Physicians Revised in the Light of Patients' Statements	General Practitioners		Specialists		Mixed Type of Practice	All Groups	
	Number	Per cent	Number	Per cent	Number	Number	Per cent
A. Physician-initiated referrals for specific reasons	14	22	4	27		18	21
B. Physician-initiated referrals for nonspecific reasons	19	30	3	20	1	23	27
C. Referrals initiated primarily by patients	31	48	8	53	4	43	51
Totals	64	100	15	100	5	84	100

that only 27 per cent of their reasons for referring the key patient fall here. This difference is a significant one ($P<0.05$) and the figures now approach those of the general practitioners in such a manner as to obviate the difference between the two types of practices. It appears that the specialists view themselves, when speaking in general terms to a physician-interviewer who is himself a specialist, as referring for more specific reasons than does the general practitioner, but in actual practice as sampled in this study, they refer for much the same reasons.

In contrast, the general practitioners in this study viewed their frequency of referral for specific reasons, in answer to the general question, very similarly to what was found in the sample of key patients referred by them: 27-30 per cent in general (Tables 3 and 4) versus 22 per cent in actual patients (Table 6).

(2) Distance of Referring Physicians from the Medical Center—The hypothesis may be stated that the farther a patient has to travel to the medical center, the more specific would be the physician's reason for referral. Thus, more referrals for specific reasons (Group A) would be expected from physicians at greater distances. In addition, it seems reasonable to expect that more patients from nearby would be primarily patient-initiated referrals (Group C). The data of this study support these hypotheses, and may be presented in two ways.

First, Table 7-A shows the frequency of physicians' reasons for referral of the key patients (revised as per Table 5 in the light of patients' statements), divided into two approximately equal groups based on distance of the referring physician from NCMH. Thirteen of the 18 patients, or 72 per cent, referred for specific reasons (Group A) were from physicians over 70 miles away. In contrast, among patient-initiated referrals (Group C), 28 out of 43, or 65 per cent, came from physicians nearer than 70 miles. These differences are significant ($P<0.05$).

Another way of presenting the same information which allows more efficient statistical use of the data, although it is an inverse approach to the problem, is comparison of the mean distance from NCMH of the physicians who gave each of the three groups of reasons for referring key patients. Table 7-B presents these results. The mean distance for specific reasons for referral is greatest and the mean distance for primarily patient-initiated referrals is least. These

differences are significant ($P<0.01$) whether all physicians are considered or general practitioners alone, or whether the reasons for referral are based upon the patients' statements or the first answer by the physician. An analysis of variance of these observations shows a highly significant difference in the distances recorded for these reasons for referral. In fact, if one should assume an equal "spacing" between the three groups of reasons, virtually all of the variability among these three groups can be explained by a linear relationship between distance and reasons for referral.

Thus, the distance from the medical center (or some factor related to distance) appears to be an important determinant of the reasons for referral of a representative group of patients. Most patients from a distance are referred for rather specific reasons; most patients from nearby come to the clinic on their own initiative, even though they work through their own physicians to arrange the "referral." In stating their general views about reasons for

Table 7—A. Answers by Referring Physicians to the Question, "Why was the Key Patient Referred?" Compared with Distance of Referring Physician from the Medical Center

First Answer by Referring Physicians Revised in the Light of Patients' Statements	Less than 70 Miles		70+ Miles		All Groups	
	Number	Per cent	Number	Per cent	Number	Per cent
A. Physician-initiated referrals for specific reasons	5	28	13	72	18	100
B. Physician-initiated referrals for nonspecific reasons	12	52	11	48	23	100
C. Referrals initiated primarily by patients	28	65	15	35	43	100
Totals	45	54	39	46	84	100

B. Comparison of Mean Distances from NCMH of Physicians Referring Key Patients for the Different Groups of Reasons

	Mean Distances, in Miles, for Physicians Referring Because of:		
	A. Physician-Initiated Referrals for Specific Reasons	B. Physician-Initiated Referrals for Nonspecific Reasons	C. Referrals Initiated Primarily by Patients
1. All referring physicians—first answer by physician	82.4	64.6	60.2
2. All referring physicians—first answer revised in light of patients' statements	85.0	67.2	59.3
3. General practitioners only—first answer by physician	79.2	65.2	54.2
4. General practitioners only—first answer revised in light of patients' statements	83.7	68.6	47.2

referral to a medical center, many relatively nearby physicians did not seem to be aware of the magnitude of patient-initiated referrals in their area.

(3) Age of Referring Physician—In a study of the medical practice of general practitioners in North Carolina, Peterson, Andrews, Spain, and Greenberg found that there was a correlation, for physicians under 35, between rank in medical school and thoroughness of the work-up of patients (history, examination, and laboratory studies).[3] On this basis, it was hypothesized that some of these younger physicians, having investigated the problem more thoroughly, would more often refer for specific reasons.

When the mean age of physicians giving each group of answers was calculated for the 84 referring physicians, there was a significant relationship between age and classification by reason for referral ($P<0.025$ by analysis of variance). The mean age of physicians who gave specific reasons for referral (Group A) was 38 years; of those who gave nonspecific reasons (Group B), 42 years; and of those for whom referral was primarily patient-initiated (Group C), 45 years.

It is noteworthy that all eight instances in which a key patient's statement that he initiated the referral was at variance with the physician's views occurred among physicians over 40 years of age, even though the sample contained approximately equal numbers under and over 40. Thus, the younger physicians seem to have either perceived or expressed their reasons for referral more precisely.

Other Observations

The present report concerns primarily the patterns of referral by physicians to a medical center and some of the characteristics of the physicians which affect these patterns. Certain related observations seem worth reporting briefly, although they will be presented in detail elsewhere.

First, 49 of the 85 physicians who referred key patients (58 per cent) sent no written or telephonic medical information with or about the patients. Thus, well over half the time the clinic entered into a consultative relationship with a referring physician without any information about the patient from the physician and no knowledge of the questions he wanted answered. This large figure was not due to the referral of patients who asked the physician to refer them: Medical information was sent about these patients as often as about others.

Second, 46 of the 85 key patients (54 per cent) had not returned to see their referring physicians (or any local physician) by the time of the home interview with the patient. This interview was from four to eight weeks after the patient's initial visit to the clinic, and was always after the work-up had been completed and a summary letter sent the referring physician. Of these 46 patients, 12 were patients who had been to see the referring physician only once, for the sole purpose of asking to be referred to the clinic; it is probably not surprising that they did not return to see the "referring" physician. No patient in this study who had such a single contact with a physician did return to see him by the time of the home interview.

It is particularly interesting to note that, except for the group of 12 mentioned above, the patients who were referred primarily on their own initiation (Group C reasons) returned to see their referring physician in as high a proportion as did patients whose referral was primarily physician-initiated (Group A and B reasons). Thus, a patient's request to be referred to a medical center does not necessarily mean the end of his relationship with his referring physi-

cian; other explanations for the poor rate of return to see the referring physician must also be sought. Fourteen patients specifically stated that, although they had not been back yet to see the referring physician, they still considered him their family physician and would return to see him when, in their opinion, the need arose.

It seems very likely that in the best interests of their health most of these 46 patients who did not return should have returned to the continuing care of a family physician; however, in only 20 did the rather complete summary letter from the physician in the clinic indicate that this was his recommendation. Thus, the staff of the clinic appears to bear part of the responsibility for the lack of return of patients to referring physicians.

Comments

In the consultative relationship between physicians certain ingredients are generally regarded as necessary if the consultation is to achieve its goal of aiding the care of the patient to the greatest possible degree. Among these ingredients are: (1) The referring physician's awareness that he needs help; (2) the consultant physician's recognition of the problem with which help is needed and his competence to supply it; (3) adequate communication between the physicians about the nature of the problem and the degree to which each is assuming responsibility for the patient's care; and (4) adequate communication with the patient, so that he understands what is to be expected from the referral, what are the consultant's recommendations, and who is to be responsible for his further care. These principles would seem to apply to the consultative role of a university clinic as they would to an individual consulting physician, in the interests of both the patients and the various physicians in training who should be learning optimal medical practice.

The results of the present study of patterns of referral to a university clinic, a clinic which emphasizes its consultative role, indicate that often neither the clinic nor the referring physician is clearly aware of the nature of the problem which led to the referral. Certainly the personnel of the General Clinic at the North Carolina Memorial Hospital, the clinic under study, has not been aware that approximately half of the patients who have come to the clinic on a physician's referral are actually coming at their own initiation. Similarly, the referring physicians, while somewhat aware of the patients' influence upon referral, tended in the interviews to underestimate its magnitude. In addition, they usually do not indicate in their referring letters that these patients apparently have certain unanswered questions which they are bringing to the consultant at the medical center.

There are doubtless many reasons for the two findings that physicians (1) have relatively infrequently defined the problem for which referral is made, and (2) have sent medical information about the patient less than half the time. Nevertheless, it seems clear that the consultant function of the clinic will be less than optimally carried out when there is inadequate definition of the problem and inadequate bilateral communication between referring physician and consultant clinic. There is no reason to think that this situation is different at other university referral clinics. The improvement of methods of exchanging information between hospital and general practice is recognized as a major contemporary problem in other countries as well.[4]

Since the patient's role in determining referral patterns to this clinic appears to be as large as that of the physicians in the area, the characteristics

of the patients who initiate referral also merit thorough examination.

Finally, the fact that more than 50 per cent of the patients had not returned to see their referring physicians within one to two months after the consultation suggests that the clinic physicians are often not making the disposition of the patient's care clear to the patient or the referring physician. This appears to be a point at which the clinics can take positive steps to encourage the prompt return of patients to their referring physicians and to clarify responsibility for continuing care, and can then examine the results.

Many further studies and operational experiments of the type just suggested are needed if this and other university clinics are to fulfill their proper consultative and teaching functions.

Summary

1. As one phase of a study of the role of a university clinic in the medical care of a largely rural area, where such a clinic serves a primarily consultative function, physicians' reasons for referral to the clinic have been described and some of the factors which affect this referral process have been determined.

2. Physicians' reasons for referral to a medical center can be grouped as follows: (a) Referral initiated by physicians for rather specific reasons which indicate some degree of delineation of the problem prior to referral; (b) referrals initiated by physicians for nonspecified reasons which appear to indicate an awareness of the existence of a problem warranting referral but without delineation of it; (c) referrals initiated primarily by the patients, either by direct request for referral by the patient or through recognition by the physician that there has been loss of rapport.

3. Evidence from interviews with a representative sample of 84 referring physicians and the patients they referred indicates that approximately 50 per cent of referrals nominally initiated by physicians to this clinic are probably referrals made primarily on the patients' initiation. In only about one-fourth of referrals was a rather specific, physician-initiated reason for referral given.

4. Distance from the medical center, or some factor related to it, appears to be an important determinant of reasons for referral. Referrals from greater distances were largely for specific, physician-initiated reasons, whereas referrals from nearby were largely patient-initiated. Physicians, though aware of the patients' influence upon their patterns of referral, seemed to underestimate its magnitude and did not indicate that they were aware of the relationship of distance from the referral center to specificity of the problem.

5. The general views of general practitioners about their patterns of referral coincided more closely with what was actually found with a sample of specific patients than was true for specialists.

6. The mean age of physicians giving specific reasons for referral is lower than that of physicians giving nonspecific reasons. Physicians under 40 as a group appear to recognize more readily and precisely the instances in which the patient initiates the referral.

7. Other observations which also have important bearing upon the consultative and teaching role of the university clinic are that for 58 per cent of the referrals in this sample no medical information was sent by the referring physician, and that 54 per cent of the patients in the sample had not returned to a continuing relationship with the referring physician after the clinic work-up was completed.

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APPENDIX

Categorization of Answers to Physician Questionnaires

(Portions Pertinent to the Present Report)

I. Why does he refer patients to a medical center?

Group A: Physician-initiated referrals for specific reasons:

(a) Problems outside the voluntarily set limits of the physician's practice; for example, the general practitioner who does no surgery.

(b) Problems which the physician considers beyond his competency but in his field of medicine. In this group are included such instances as the general practitioner who does obstetrics but who may refer patients with complications to a specialist.

(c) For more specialized diagnosis and treatment. This represents relatively advanced thinking and narrowing of diagnostic possibilities to a particular specialty or field; for example, the internist may have made the diagnosis of some renal or hematological disease yet he may refer the patient to a specialist for a specific diagnosis and clarification of the problem. This applies also to the mention of specific specialists who may not be available in his community.

(d) Because of inadequate local facilities. This category applies to physical facilities such as laboratory and x-ray equipment as well as to the lack of ancillary personnel such as house staff and nursing staff.

(e) Patients who present instructive teaching problems.

Group B: Physician-initiated referrals for nonspecific reasons:

(a) For diagnosis and treatment. This category includes both explicit and implicit reasons. It includes reasons such as "confirmation of diagnosis" and "to reassure the physician," as well as more explicit answers. This category is general and makes no reference to a specialist or to a specific clinical problem. For example, "complete work-up" and "complex problems" are coded here. Reference to "specialists" without differentiation or specification is coded here.

(b) For unified clinical facilities. Answers in this category refer to the facts that the patient may see several physicians for the cost of one clinic visit, that multiple opinions are available at the time of the single visit, and also that the patient is seeing more than one physician, allowing for the expression of more than one opinion. The occasional answer that patients are referred to the medical center rather than to a local physician where the patient may be "lost" to the referring physician is placed in this category.

Group C: Referrals initiated primarily by patients:

(a) Direct request of patient or family.

(b) Apparent loss of rapport between physician and patient. This category includes reasons such as "to reassure the patient," "frustrated by the patient's complaints," "difficulty in managing patient," etc. It may be used when the physician senses dissatisfaction by the patient and refers him.

(c) Medically indigent patients.

II. Why was the key patient referred to NCMH? The categories of answers for this question are the same as those for Question I.

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This paper offers an account of the origin and progress of the New York State prepayment studies. It provides illustrations of data gathered from routine sources and of findings that can be obtained from analysis of these materials. Finally, recommendations based on the observations are presented.

UTILIZATION OF ROUTINELY AVAILABLE INFORMATION ON HEALTH INSURANCE STUDIES

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IT IS WITHIN the discretion of the superintendent of insurance of New York State to hold public hearings as to the reasonableness of a request made by any nonprofit prepayment plan such as Blue Cross for an increase in premium rates. Thus, hearings were held both upstate and in New York City in 1957 and early 1958. The two hearings occasioned by the rate increase request of the New York City Blue Cross Plan, which has more than seven million subscribers in New York City and adjoining counties, were distinguished by many conflicting statements, lack of adequate information in certain areas of testimony, considerable evidence of misunderstanding, and in some instances poor relations between some of the parties involved in the problem.

As a result the superintendent of insurance* and the commissioner of health† came to the conclusion that an extensive review of the entire nonprofit prepayment movement in the state by a university research group would be both timely and appropriate. A governor's message to this effect went to the legislative session of 1958 and legislation was introduced with bi-partisan sponsorship which would have made such studies possible and would finance them by a legislative appropriation. The proposed legislation was not reported out of committee.

Subsequently the superintendent of insurance advised representatives of the plans that the studies were still needed; and each plan was requested to participate in financing the work in an amount based on the premium income of each. The total of all contributions was to be $150,000. All plans (eight Blue Cross, seven Blue Shield, and three independent plans) agreed to share this cost. In addition, university resources, Macy Foundation funds, and funds from Grant W17 of the Federal Hospital Council were used. The plans also contributed a large volume of machine tabulations.

The superintendent of insurance, the commissioners of health, welfare, and education, and the special assistant to the governor considered several research approaches to the work to be done and

* Then Mr. Julius Wikler.
† Dr. Herman E. Hilleboe.

extended an invitation to the School of Public Health and Administrative Medicine to enter into a research contract. The principles involved in this working agreement are stated in the following excerpts from the contract:

"Conduct research studies and make reports on certain health insurance problems in the State of New York. Said studies are intended to include but not be restricted to such areas as the public purpose of health insurance plans, their historical development in New York State, their present status and problems, corporate features, hospital-plan interrelationships, boards of directors, reimbursement formulae, hospital costs and utilization, hospital operation, physician-plan interrelationships, service benefits, medical staff and medical society review of member activities as they affect plans and hospital utilization, financial structure of the health insurance plans, premiums, benefit structures, community rates and related problems that should and can be studied with the available funds and other resources.

"The School will be responsible for the detail of the research design, the development of research methodology, the supervision and reporting of all research to be done under the terms of this contract."

While time limits and budgetary consideration have precluded examining all questions in equal research depth, a great deal has been accomplished by a staff of 20 professional people with the help of the plans, several state departments, several national organizations, and five advisory committees, and some consultants. The work really began on a full-scale basis in September, 1958. The first volume dealing with the eight Blue Cross Plans in New York State was completed and distributed for comment to committees and consultants in the fall of 1959 and published as an independent study by the superintendent of insurance and the commissioner of health of New York in June, 1960. It analyzes, discusses, and/or makes recommendations in the following areas: history and purpose of Blue Cross; state laws and the state insurance department; boards of directors and plan administration; benefits; hospital costs; costs in relation to such factors as size, services, and education; reimbursement; utilization; prepayment to unaccredited hospitals; and long-range community planning. The report was completed after consideration of comments from about 90 committee members and consultants. (The study staff is completing a similar review of the seven Blue Shield Plans in New York, Group Health Insurance, the Health Insurance Plan of Greater New York and the Group Dental Health Insurance Plan.) This presentation, however, will be confined to some selected examples of the use of routinely available information in attempts to answer questions about utilization raised by the superintendent of insurance.

The tables presented are examples of the kinds of information that can be constructed from data routinely available from a variety of sources. Many other similar presentations of data exist pertaining not only to utilization, but to other subjects covered in the full report. Some of the data are publicly available. Some require research cooperation or authorization to be mobilized for analysis.

Approaching the subject of utilization on a state-wide basis, it is of interest first to examine the average length of stay for the six large Blue Cross Plans in New York State (this excludes two one-county plans from consideration). As a deliberate selection, data pertaining to individuals admitted under Blue Cross coverage during 1957 on Tuesdays and on Fridays were studied. These patients were classified either as (a) medical or surgical patients, or (b) by the Blue Cross-Blue Shield 12-break diagnosis and treatment code excluding maternity, tonsillectomy, and adenoidectomy patients, or (c) in the case of the New York City Plan, specific diagnoses were also examined for average length of stay. Table 1 demonstrates that the

Table 1—Hospital Use Study: Average Number of Hospital Inpatient Days Stay, Nonmaternity Blue Cross Subscribers, by Diagnosis, New York State and by Plan: 1957

Type of Treatment	Blue Cross Plan, Average Length of Stay, Sample A (Tuesday Admissions) and Sample B (Friday Admissions) Combined						
Blue Cross-Blue Shield 12-Break Diagnosis and Treatment Code. Maternity and T&A Excluded.	Utica Plan Av. Days	Syracuse Plan Av. Days	Rochester Plan Av. Days	Buffalo Plan Av. Days	New York City Plan Av. Days	Albany Plan Av. Days	New York State* Av. Days
Surgical Treatment							
4 Digestive system	7.8	8.9	10.0	9.1	11.2	10.0	10.6
5 Genitourinary system	6.5	6.0	6.9	7.1	8.3	7.0	7.9
6 Benign tumors	4.5	6.6	6.3	7.0	6.9	7.0	6.8
7 Injuries and poisonings	7.7	8.3	11.1	8.4	8.8	11.0	8.9
8 Other surgery	8.7	8.7	9.6	10.1	9.1	10.4	9.3
Surgical treatment—Total	7.4	7.9	9.0	8.6	9.1	9.2	8.9
Medical Treatment							
9 Respiratory system	6.9	6.8	7.1	7.4	8.6	8.1	8.1
10 Digestive, genitourinary	5.7	5.5	6.7	7.4	8.7	7.3	8.0
11 Circulatory	11.9	11.1	13.5	14.5	14.3	14.3	14.0
12 Other medical	8.0	8.3	8.4	10.5	9.3	9.1	9.2
Medical treatment—Total	7.9	7.8	8.7	9.7	10.1	9.7	9.7
All conditions—Total	7.7	7.8	8.9	9.1	9.5	9.4	9.3
Surgery—Tuesday	7.4	†	8.4	8.6	9.1	9.1	8.9
Surgery—Friday	7.3	—	10.4	8.6	9.0	9.4	8.9
Medical—Tuesday	7.5	—	8.2	9.4	9.9	9.2	9.4
Medical—Friday	8.4	—	9.4	10.0	10.3	10.2	10.0
Total—Tuesday	7.5	—	8.3	9.0	9.4	9.1	9.1
Total—Friday	7.9	—	9.8	9.2	9.7	9.8	9.5
Total cases	5,501	8,546	9,746	14,627	104,117	8,508	151,045
Total days	42,108	67,002	86,608	132,901	991,069	80,378	1,400,066

* All plans; samples A and B combined; includes Syracuse.
† Tuesday-Friday information not available for Syracuse Plan. Samples A and B equal random 1/7 of inpatient paid claims for 1957.

Utica Blue Cross Plan subscribers had the shortest average length of stay for all surgical conditions and were almost identical in the average length of stay for medical conditions with the lowest plan in the state—namely Syracuse. The Utica Plan subscribers when examined on an over-all basis, as shown in Table 1, had the shortest average length of stay for combined medical and surgical admissions in the state. By contrast the New York City Plan was almost at the top of the list in terms of average length of stay for surgical admissions of Blue Cross subscribers and had the highest average length of stay for medical admissions. For the two combined it had the highest average length of stay of all six plans.

In examining the differences in length of stay between patients admitted on Tuesday and patients admitted on Friday, the Rochester Plan stands out with an average of two days' difference in the length of stay for Friday surgical admissions versus Tuesday surgical admissions; in addition, there is a 1.2 difference for Tuesday and Friday medical admissions. In every plan the over-all average length of stay for Friday medical and surgical admissions was longer than for Tuesday medical and surgical admissions.

As an intermediate level of data refinement, voluntary New York City member hospitals of the Blue Cross Plan were studied individually, but grouped by size. The interesting observations include the fact that among the smaller hospitals there was considerable fluctuation in terms of which day of the week, namely Tuesday or Friday, patient admissions had the longer average length of stay; but in the larger hospitals the Friday admissions always had an average length of stay which was greater. This was uniformly true for medical admissions also, but the differences observed were not statistically significant. However, when the surgical and medical admissions on Friday were combined, the length of stay for Friday admissions was significantly greater in six of the seven largest voluntary hospitals in New York City. Since the differences are substantial and these hospitals are the largest providers of service to Blue Cross subscribers, the drain on Blue Cross income is considerable.

A third level of refinement of data available from routine claims forms is shown in Tables 2 and 3. Table 2 refers to length of stay for appendectomy patients in 14 selected hospitals in New York City. The points of interest are related to the "all cases" totals and to the two younger age groups. When patients are categorized by age, as well as by diagnosis, differences in length of stay narrow considerably. This type of table indicates the need for as much refinement as possible in length of stay data by age and diagnosis before coming to conclusions that there are significant differences between institutions.

Table 3 presents the same type of information for coronary patients. The shorter length of stay in proprietary hospitals stands out. This is generally true in most length of stay analyses of hospitals by sponsorship and size. Coronary patients in the six large voluntary hospitals had an average length of stay of 20.7 days for patients 55 through 64 years of age; for five proprietary hospitals similar patients had an average length of stay of 14.5 days. Understanding the large differences requires some knowledge of the severity of illness, the soundness of professional judgment in the various institutions, and clearly indicates the need for professional review.

Turning from average length of stay to the use of ancillary services, data are presented in Table 4 which summarize the over-all results of a study in four hospitals in the Albany Blue Cross area and the Syracuse Blue Cross

Table 2—Hospital Use Study: Length of Stay Data for Appendectomy Patients by Age: 1957

Sample A (Tuesday) and Sample B (Friday) Combined

Hospital Name	No. Beds	Location (County)	Total Cases	Total Days	Av. Stay	Age 1-34 Cases	Age 1-34 Days	Av. Stay	Age 35-54 Cases	Age 35-54 Days	Av. Stay	Age 55-64 Cases	Age 55-64 Days	Av. Stay	Age 65 and Over Cases	Age 65 and Over Days	Av. Stay
Voluntary																	
33 University	374	New York	17	125	7.4	13	91	7.0	2	18	9.0	2	16	8.0	—	—	—
57 Maimonides	527	Kings	36	283	7.9	29	226	7.8	4	30	7.5	3	27	9.0	—	—	—
39 St. Luke's, N. Y. C.	715	New York	22	213	9.7	14	108	7.7	6	74	12.3	1	17	17.0	1	14	14.0
920 Mt. Sinai	986	New York	28	236	8.4	20	160	8.0	7	61	8.7	—	—	—	1	15	15.0
26 New York	996	New York	40	290	7.3	22	136	6.2	14	118	8.4	4	36	9.0	—	—	—
34 Presbyterian	1,459	New York	42	465	11.1	30	289	9.6	9	105	11.7	—	—	—	3	71	23.7
		Subtotal	185	1,612	8.7	128	1,010	7.9	42	406	9.7	10	96	9.6	5	100	20.0
Proprietary																	
171 Royal	107	Bronx	32	279	8.7	22	160	7.3	4	47	11.8	4	52	13.0	2	20	10.0
29 Park East	117	New York	23	191	8.3	14	105	7.5	4	26	6.5	3	45	15.0	2	15	7.5
209 Trafalgar	130	New York	27	213	7.9	20	146	7.3	5	50	10.0	2	17	8.5	—	—	—
205 Kings Highway	137	Kings	30	235	7.8	25	175	7.0	4	39	9.8	1	21	21.0	—	—	—
181 Horace Harding	278	Queens	69	606	8.8	51	397	7.8	11	112	10.2	6	87	14.5	1	10	10.0
		Subtotal	181	1,524	8.4	132	983	7.4	28	274	9.8	16	222	14.8	5	45	9.0
Church																	
80 St. Vincent's, S. I.	252	Richmond	46	394	8.6	36	260	7.2	8	114	14.3	1	7	7.0	1	13	13.0
37 St. Clare's, N. Y. C.	440	New York	19	178	9.4	13	104	8.0	3	31	10.3	2	41	20.5	1	2	2.0
40 St. Vincent's, N. Y. C.	768	New York	27	261	9.7	17	118	6.9	7	84	12.0	1	15	15.0	2	44	22.0
		Subtotal	92	833	9.1	66	482	7.3	18	229	12.7	4	63	15.7	4	59	14.7
		Total	458	3,969	8.7	326	2,475	7.6	88	909	10.3	30	381	12.7	14	204	14.5

Table 3—Hospital Use Study: Length of Stay Data for Coronary Patients by Age: 1957

Sample A (Tuesday) and Sample B (Friday) Combined

Hospital Name	No. Beds	Location (County)	Total Cases	Total Days	Av. Stay	Age 1-34 Cases	Age 1-34 Days	Av. Stay	Age 35-54 Cases	Age 35-54 Days	Av. Stay	Age 55-64 Cases	Age 55-64 Days	Av. Stay	Age 65 and Over Cases	Age 65 and Over Days	Av. Stay
Voluntary																	
33 University	374	New York	57	964	16.9	2	36	18.0	17	275	16.2	16	288	18.0	22	365	16.6
57 Maimonides	527	Kings	153	2,279	18.3	3	35	11.7	42	863	20.5	60	1,256	20.9	48	645	13.4
39 St. Luke's, N. Y. C.	715	New York	35	607	17.3	2	10	5.0	8	184	23.0	13	205	15.8	12	208	17.3
920 Mt. Sinai	986	New York	134	2,708	20.2	1	4	4.0	39	712	18.3	48	1,137	23.7	46	855	18.6
26 New York	996	New York	86	1,802	21.0	1	8	8.0	30	645	21.5	34	696	20.5	21	453	21.6
34 Presbyterian	1,459	New York	79	1,421	18.0	—	——	——	16	294	18.4	35	687	19.6	28	440	15.7
		Subtotal	544	9,781	17.9	9	93	10.3	152	2,973	19.6	206	4,269	20.7	177	2,966	16.8
Proprietary																	
171 Royal	107	Bronx	36	473	13.1	—	——	——	9	114	12.7	20	272	13.6	7	87	12.4
29 Park East	117	New York	39	500	12.8	—	——	——	13	158	12.2	15	149	9.9	11	193	17.5
209 Trafalgar	130	New York	37	607	16.4	—	——	——	6	94	15.7	17	277	16.3	14	236	16.9
205 Kings Highway	137	Kings	26	517	19.9	—	——	——	7	176	25.1	13	272	20.9	6	69	11.5
181 Horace Harding	278	Queens	95	1,243	13.1	1	4	4.0	41	499	12.2	36	500	13.9	17	240	14.1
		Subtotal	233	3,340	14.3	1	4	4.0	76	1,041	13.7	101	1,470	14.5	55	825	15.0
Church																	
80 St. Vincent's, S. I.	252	Richmond	41	719	17.5	—	——	——	16	267	16.7	13	246	18.9	12	206	17.2
37 St. Clare's, N. Y. C.	440	New York	42	714	17.0	1	3	3.0	19	357	18.8	14	215	15.4	7	113	16.1
40 St. Vincent's, N. Y. C.	768	New York	87	1,331	15.3	—	——	——	28	425	15.2	28	421	15.0	30	481	16.0
		Subtotal	170	2,764	16.2	1	3	3.0	63	1,049	16.6	55	882	16.0	49	800	16.3
		Total	947	15,885	16.8	11	100	9.1	291	5,063	17.4	362	6,621	18.3	281	4,591	16.3

Table 4—Charges Incurred by Medical and Surgical, Maternity and Tonsillectomy Patients in Four Upstate Hospitals. Matched Sample of Blue Cross and General Electric Patients. Patients Matched for Age, Sex, Hospital Diagnostic Group, and Type of Accommodation

					Ancillary Service Charges							
					Laboratory		X-Ray		Electrocardiogram		All	
	No. of Patients	Days Stayed	Av. Stay	Aggregate Total Hospital Charges	Amount	% of Total	Amount	% of Total	Amount	% of Total	Amount	% of Total
Total Sample												
Blue Cross	282	2,266	8.0	$68,525	$5,921	.08	$3,485	.05	$1,082	.02	$10,488	.15
General Electric	282	2,080	7.4	66,597	5,992	.09	3,312	.05	1,073	.02	10,377	.16
Albany area Subsample												
Blue Cross	215	1,941	9.0	58,512	5,204	.09	3,010	.05	942	.02	9,156	.16
General Electric	215	1,673	7.8	54,576	5,340	.10	2,780	.05	983	.02	9,103	.17
Hospital A												
Blue Cross	143	1,391	9.7	43,353	3,627	.08	2,115	.05	867	.02	6,609	.15
General Electric	143	1,153	8.1	38,630	3,447	.08	1,852	.05	622	.02	5,921	.15
Hospital B												
Blue Cross	72	552	7.6	15,159	1,577	.10	895	.06	75	*	2,547	.17
General Electric	72	537	7.2	15,946	1,893	.12	928	.06	361	.02	3,182	.20
Syracuse area Subsample												
Blue Cross	67	325	4.9	10,013	717	.07	475	.05	140	.01	1,332	.13
General Electric	67	407	6.1	12,021	652	.06	532	.04	90	.01	1,274	.11
Hospital C												
Blue Cross	61	302	5.0	9,364	685	.08	440	.05	140	.01	1,265	.14
General Electric	61	386	6.3	11,443	632	.06	482	.04	90	.01	1,204	.11
Hospital D												
Blue Cross	6	23	3.8	649	32	—	———	—	———	—	67	—
General Electric	6	21	3.5	578	20	—	50	—	———	—	70	—

*=½ of 1 per cent or less.

area. These hospitals were utilized by patients with Blue Cross coverage and by General Electric coverage (a major medical type of commercial insurance with a deductible and coinsurance feature). Proponents of major medical insurance have asserted that deductibles and coinsurance reduce utilization.

The study is based on the collection of business office data from more than 3,000 discharged patients who left the four hospitals in March, 1958. From among the 3,000 patients, matched samples categorized by age, sex, type of accommodation, and diagnosis were constructed. Thus a total of 282 patients with Blue Cross in one or the other of two Blue Cross Plans and 282 patients with General Electric coverage were matched. (Unfortunately in one of the four hospitals studied the number of General Electric patients was so small as to make the findings meaningless. The data are included for the sake of completeness.) In studying the dollar volume for charges for ancillary services, both as a total of dollars and as a percentage of the total hospital charges, it is seen that there are no differences. However, in the Albany area Blue Cross patients had a longer average length of stay, while in the Syracuse area the General Electric patients had a longer average length of stay. Furthermore, the dollar volume of charges for ancillary services in the Albany area was approximately twice that on a per-case basis experienced in the Syracuse area for patients with both types of coverage.

These findings are interesting because the Albany Blue Cross Plan reimburses hospitals on the basis of 97 per cent of posted charges. Consequently, there would be no apparent reason for the Albany hospitals to restrict services by any administrative procedure. The Syracuse Plan pays hospitals on the basis of "costs" and there might be some reason for hospital administrators to keep their costs as reasonable as possible. The General Electric Plan is supposed to control charges by the deterrents imposed by deductibles and coinsurance. Since no differences existed in either plan area, the conclusion that physicians tend to practice medicine for insured patients in essentially the same way in any given hospital suggests itself most prominently. Naturally these findings arouse a desire for further scrutiny.

The subject of long-stay patients is prominent in every review of hospital utilization because such patients utilize a substantial proportion of the total days paid for by Blue Cross. Individuals, hospitals, and plans vary in their approach to the problem. Many factors enter into the issue of the long-stay patient and have been commented on in other studies. It is interesting to note the effect of an administrative procedure in the New York City Blue Cross Plan. The original approval of the plan, when an eligible subscriber or member of a covered family enters the hospital, is for 21 days of full coverage plus 30 half-benefit days. On or before the 51st day the hospital is required to request additional days of benefit if the patient is to remain covered by Blue Cross. The request for additional days requires an administrative decision and may result in an interview with the attending physician and/or the patient. The request for additional coverage must be repeated every 30 days. The New York City Blue Cross Plan provided data to the study of 3,692 patients who were discharged during March, 1958, and whose length of hospital stay was 22 days or longer. These patients were discharged in a steadily decreasing number each day except when the recertification process intervened. Table 5 summarizes the pertinent information with respect to the effect of recertification. On the 51st, 81st, and 111th day of Blue Cross

Table 5—Hospital Patients Covered by the New York City Blue Cross Plan Whose Length of Stay was 22 Days or More and Who Were Discharged in March, 1958

Length of Stay in Days	Number of Patients in Hospital on Stated Day	Number Discharged on Stated Day	Per cent Discharged
50	611	21	3.4
51	590	270	45.8
52	320	16	5.0
80	118	5	4.2
81	113	19	10.7
82	94	3	3.2
110	47	1	2.1
111	46	12	26.4
112	34	1	2.9

coverage patients were discharged at rates of 45.8, 10.7, and 26.4 per cent, respectively, whereas on the days before, the discharge rates were 3.2, 4.2, and 2.1 per cent successively. The data speak clearly. A certain proportion of people each month are in hospitals for nonmedical reasons. No detailed case studies were possible in this review. It is to be hoped that those who were not recertified suffered no hardship; nevertheless, the effect of this administrative procedure is striking and if applied reasonably leads to some saving to the Blue Cross subscriber group. More research is necessary in this area.

Utilization in terms of the qualifications of physicians performing surgery is of considerable significance to patients and hospital and medical care health insurance. As part of our studies for the state, six Blue Shield Plans and two independent plans in New York have provided to the study group data for all or part of 1958 which lists by hospital each doctor's name by the 25 most frequent operations and all other surgery performed. These data are being analyzed in detail. Table 6 is a simple presentation by size of hospital of the recorded qualifications of physicians performing four common operations. The sources of data for the qualifications of the physicians performing the surgery were existing directories and data available through punch-cards from the American Medical Association. A study reported elsewhere has demonstrated that the underenumeration of physician qualifications in terms of specialty board certification or being a member of an appropriate professional college is in the order of 3 to 4 per cent. Thus the errors are quite small in relation to the size of the observations. In one study, which will be reported to the state, we have demonstrated that the proportion of major surgery performed by qualified surgeons in different New York hospitals varies from 100 per cent to less than 1 per cent and that this variation is related to size and ownership of hospital. In Table 6, the size of the hospital is usually correlated with a nonmetropolitan location and/or proprietary ownership. This is not uniformly so but very strong associations exist between these

two factors and the low percentage of qualified surgeons doing major surgery.*

The subject of the utilization of unaccredited hospitals is of community-wide concern also. Table 7 summarizes the accreditation of member hospitals of the eight Blue Cross Plans in New York State by ownership. It is easy to see that while there are unaccredited hospitals throughout the state, the problem is concentrated in the New York City Blue Cross Plan area where only 15 of 53 proprietary hospitals are accredited. Table 8 illustrates the dimensions of the problem, in terms of financing care in unaccredited hospitals. Using the New York City Blue Cross Plan in 1958 as an example, $22,257,000 was paid to unaccredited hospitals, or 18 per cent of the total amount paid to all New York State hospitals. Of this amount, almost $16,000,000 went to unaccredited proprietary hospitals, or 12 per cent of the total paid to all hospitals.

Simple observations, such as the data presented in this paper, are not new, but the interest of the public and the professions is more intense. Further, there is a more open realization that some form of action has to occur to deal with the questions so easily raised. In concluding it may be pertinent to give a few examples of recommendations which are being made in our report to the state in relation to the data presented. These are not binding on the state, but there is reason to believe some will be implemented. First, primary emphasis is being placed on the need for more definitive community review and planning, with regional councils having greater authority and with some form of state-wide coordinating agency. Second, recertification procedures should be revised to require more frequent review of patient status. This will serve to reduce some unnecessarily long stays, but what is more important it will reinforce community planning for other types of services by spotlighting deficiencies. Third, with respect to accreditation it is being recommended that Blue Cross return to its original policy in New York State of paying only accredited hospitals. A transition period of three years is suggested during which time unaccredited hospitals would be paid audited costs. After such time it is recommended that unaccredited hospitals not be paid. Many other recommendations have been made but these examples are demonstrative.

* These data are from a large-scale study by Dr. Milton Maloney, assistant professor of administrative medicine.

Table 6—Proportion of Operations Performed by Physicians who Are Certified Surgical Specialists or Fellows of the American College of Surgeons or American College of Obstetrics and Gynecology According to Size of Hospital, for Four Selected Procedures in Blue Cross Member Hospitals, Paid for by New York City Blue Shield in 1958

No. of Beds	All		Appendectomy		Cholecystectomy		Hysterectomy		Mastectomy	
	N	%	N	%	N	%	N	%	N	%
All (N=100%)	17,639	64.5	7,260	55.4	3,938	67.0	5,332	71.8	1,109	80.1
Under 100	2,634	46.2	1,384	38.9	494	48.0	678	56.9	78	69.2
100-199	5,952	57.0	2,853	52.5	1,348	59.9	1,506	61.6	245	66.0
200-299	4,242	69.0	1,563	59.8	891	71.7	1,391	72.5	397	86.9
300 and over	4,811	79.8	1,460	72.0	1,205	79.2	1,757	85.7	389	84.3

Table 7—Accreditation Status of Member Hospitals of Eight Blue Cross Plans by Ownership, as of December 31, 1958*

Plan Area	Total		Ownership							
			Religious		Proprietary		Governmental		Voluntary	
	Number of Hospitals	Number Accredited	Number of Hospitals	Number Accredited	Number of Hospitals	Number Accredited	Number of Hospitals	Number Accredited	Number of Hospitals	Number Accredited
Albany	25	19	6	5	0	0	0	0	19	14
Buffalo	30	25	9	9	1	0	5	4	15	12
Jamestown	4	3	0	0	0	0	1	1	3	2
New York	184	128	26	26	53	15	2	2	103	85
Rochester	19	13	1	1	1	0	2	1	15	11
Syracuse	24	21	6	5	0	0	5	5	13	11
Utica	29	24	3	3	1	0	9	6	16	15
Watertown	5	2	1	1	2	0	0	0	2	1
Total	320	235	52	50	58	15	24	19	186	151
Per cent accredited of those eligible		73		96		26		79		81

* Hospitals with less than 25 beds have been omitted from this table since they are ineligible for accreditation, even though Blue Cross accepts them as member hospitals.

Table 8—Blue Cross Payments in 1958 to Hospitals in New York State, by Accreditation Status According to Questionnaires Completed by Plans

Plan	Total Days Paid (full and partial) in All New York State Hospitals	Total to All Unaccredited Hospitals, 25 Beds and Over	Per cent of Total	Total to All Unaccredited Proprietary Hospitals, 25 Beds and Over	Per cent of Total	Total Amount Paid to All New York State Hospitals	Total to All Unaccredited Hospitals, 25 Beds and Over	Per cent of Total	Total to All Unaccredited Proprietary Hospitals, 25 Beds and Over	Per cent of Total
Albany	433,928	24,414	5.6	not answered	not answered	$11,901,786.60	$524,397.21	4.4	not answered	not answered
Buffalo	770,691	32,083*	4.1	8,296*	1.0*	17,935,788.18	680,152.31*	3.7*	$175,331.45*	0.97
Jamestown	41,731	2,601	6.2	0	0	739,496.31	45,432.72	6.1	0	0
New York City	5,422,609	925,922	17.0	643,282	11.8	123,275,952.69	22,257,783.06	18.0	15,777,183.80	12.0
Rochester	448,274	16,024	3.5	1,928	0.43	11,341,546.50	322,561.39	2.8	33,409.89	0.2
Syracuse	431,994	16,428	3.8	55	0.01	8,954,455.89	307,673.90	3.4	586.87	0.06
Utica	212,824	10,837	5.0	4,266	2.0	4,289,356.10	not answered	not answered	not answered	not answered
Watertown	34,597	5,211	15.0	2,853	8.2	637,483.48	84,125.98	13.0	47,907.82	7.6

* Pertains to member hospitals only. Additional payments to other unaccredited hospitals estimated to be very small.

In summary, this paper presents an account of the nature and progress of the New York State prepayment studies, and provides illustrations of data gathered from routine sources and of recommendations based on the observations. There are many fertile areas of undeveloped research still ahead.

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Journals Wanted

If there are any readers who have no further need of their March, 1960, Journals, the Association would be grateful if these would be returned to the Association at 1790 Broadway, New York 19, N. Y.

A recent President of the Association makes a number of observations on today's public health problems, and probes some of the influences which led up to them. She offers some projections into the future in a searching analysis which should stimulate public health workers in their visualization of the whole field as well as in their everyday tasks.

PUBLIC HEALTH IN AN AFFLUENT SOCIETY

Leona Baumgartner, M.D., F.A.P.H.A.

THE great economist, Alfred Marshall, writing half a century ago said, "The economist like everyone else must concern himself with the ultimate aims of man." This observation could be paraphrased to apply to those who are concerned with the problems of public health, as well. All of us—nurses, doctors, administrators, research workers, technicians, educators—are practicing our profession in an economic and political environment which has a profound impact on our daily operations and decisions, and on our long-range planning.

The obligation to be literate in this field falls upon every member of a free society which must find the wisdom to identify and solve the economic problems that freedom imposes. It is especially incumbent upon those in the health professions where social priorities and social decisions are increasingly important. I wish to discuss the nature of our obligation as specialists in the framing of those social decisions, not with the expertness of an economist or even of a crystal gazer, but as the working synthesis constructed for her own use by one physician with a reasonable amount of public administrative experience.

The transformation of human life in the past 300 years has been truly remarkable, and science and technology—the ability of man to understand and control his physical environment—have been important in that transformation. But man has changed his life on earth as much by his conscience and the deliberate political and economic acts proceeding therefrom as he has by science, whether medicine, physics, or chemistry.

Political leaders must deal with issues that are primarily moral and human, but behind their decisions stand the array of choices dictated by the existing state of science. This array of possible alternatives delimits the area of political choice. Within these limits the outcome is determined as much by the actions we fail to take as by those we take.

Political decisions therefore need to be based on a comprehensive and rational grasp of scientific facts. As the technology of industrial civilization becomes more complex, it becomes more urgent that political leaders and voters alike have a grasp of the human consequences of their decisions.

But the scientist and technologist have an equal need to grasp the significant

outlines of moral and ethical choices, if only for the practical reason that the politician may not know the questions he should be asking of the technician, and the technician may not otherwise know what in his arsenal of knowledge can be useful in arriving at answers to political questions.

In an important sense this relationship between political wisdom on the one hand and science and technology on the other has characterized the entire history of public health, of man's endeavor to protect himself and his community against disease. This has been true throughout history from the time the primitive community isolated or even destroyed the contaminating patient, to the present concept of the positive protection of the healthy from the dangers of possible disease. In the more immediate past, in this country and in Great Britain, public health has been a partner to the most active and liberal tradition of social progress, to the Chadwicks, the Shattucks, the Florence Kellys, the Lillian Walds. Persons from many professions were part of the early twentieth century war on proverty, filth, ignorance, and exploitation. The conquest of communicable disease has come simultaneously with a rising standard of living, great economic growth, and the establishment of social minimums of protection against unemployment, old age, indigence, and exploitation.

The nature of this relationship between public health and social progress seems to remain the same in our time, but the nature of the problems we must deal with is profoundly different. The definition of these new problems is only now beginning to be clarified for us. The central core of this change is of course the conquest of the communicable diseases, and the emergence of the chronic illnesses as a focus of our efforts. The nature of the problems presented by these diseases is further complicated by current limitations of scientific knowledge relevant to their causation, prevention, therapy, or control.

The consequence of these facts is that the provision of adequate health services today makes profound demands upon social and cooperative effort. Those who are concerned with the discharge of governmental responsibility for the protection and improvement of community health find that problems of prevention and treatment are interrelated, and are increasingly pressed into a concern with the availability of medical care. At the same time the individual practicing physician who provides this care finds himself increasingly dependent upon diagnostic tools and the coordinated use of team skills that go far beyond what can be contained in any one physician's little black bag.

This new and still changing situation poses new kinds of issues. It raises specific social, financial, and administrative questions that must be faced in developing the institutions and methods that will serve us best and that will most equitably permit our citizens to participate in the benefits of advancing medical knowledge.

Changing Patterns in Our Society

The economic and political environment in which these questions must be answered is one which reveals an unprecedented rate of economic growth accompanied by an income and manpower revolution. The United States has achieved a per capita output in the past 20 years that was simply undreamed of in the past. Contrary to the mid-nineteenth century predictions of Karl Marx, that envisaged the polarization of society with the rich getting richer and the poor getting poorer, we have experienced an income revolution that finds the masses of our population participating in material progress to a degree unprecedented in history.

"Poverty" in the sense of a destitute one-third of a nation has been abolished in our land at this time.

The reasons for these gains are complex and beyond the scope of this discussion. However, in a general way, the core of the explanation seems to me to lie in the assumption of public responsibility within the framework of a free society, responsibility on the one hand to encourage economic growth and to remove the "boom and bust" cycle from economic life; and on the other hand responsibility to set minimum standards to protect the individual and the family against exploitation and economic hazards—minimum wage standards, old age and unemployment insurance, decent housing, decent schooling, and health and medical care.

Our first great advance toward affluence came with the industrial revolution which released a majority of people from the farms to become available for industrial production. Today we are turning a second page in manpower history. For the first time the majority of nonagricultural workers are engaged in services rather than production. Less than 15 million people employed in manufacturing produce all of our manufactured goods; less than six million employed in agriculture produce all our food. The rest of the 65 million employed persons are related to servicing and marketing rather than direct production of goods.

This shift in manpower and growth of economic productivity has led to the development of a society with new qualities and undreamed-of horizons. Although it has become fashionable to deplore the number of people and the amount of wealth which is diverted to advertising, merchandising, and "soft-living," the same technological revolution that made "frivolities" possible, has freed an increasing proportion of our population to serve as nurses, librarians, doctors, dentists, researchers, teachers, preachers. In a single generation, the proportion of youngsters receiving a high school education has gone from a small fraction to more than 80 per cent of the children in the high school age group. At the college level, enrollment has leaped from a meager 4 per cent to 35 per cent of college age youngsters. How we use these additional resources for desirable social objectives depends upon a host of interrelated factors, but certainly, the import of this manpower and educational revolution for the field of health and medical care where present personnel shortages are acute is quite obvious.

What are some of the health needs of this new, growing population that will have to be met by our highly-skilled and trained manpower resources? What additional public service must be provided? In the next 20 years, the population of the United States is expected to increase by one-third. This increase and the internal migration of our population to the suburbs will surely aggravate existing problems of air pollution, water supply, sanitation and traffic, as well as the planning and provision of school, housing, hospital, and health services.

An older population, whose life span has been increased by tremendous leaps in medical technology, has different medical, rehabilitative, and psychological needs which demand immediate attention as well as long-range planning. The technological achievements of modern living provide more leisure time, yet the pace of modern living brings in its wake stress, the effects of which cannot be ignored.

Above all, we cannot be complacent about the considerable sectors of underprivilege and disadvantage which paradoxically still persist in our affluent society. Geographic pockets of unemployment accompany the decline of old industries and the rise of new ones.

Families subsist on marginal farm land. The barriers of prejudice restrict the economic opportunity of minority groups. Migratory workers live completely outside the pale of the general fabric of social protection enjoyed by other citizens, including health services and educational opportunities commonly available to the latter. Composite problems limit the opportunity of youth in low-income families to break out of the self-perpetuating cycle of inadequacy and poverty. An assistant secretary of health, education, and welfare in the present administration reported recently that 44 per cent of the families in this country had incomes below $5,000 in 1957, and that one family in nine had an income below $2,000. Families with no discretionary income have no savings, and as many as one-fourth of all American families have no cash savings today, while more than half our families have cash savings of less than $500.

Public Responsibility in an Affluent Society

We have come a long way from placing the burden of alleviation and solution of these social problems upon the individuals involved. Today, with the concept of "the assumption of public responsibility" established, we need to avoid being tripped by clichés of the past. It is not a question, for example, of whether government should or should not be involved in public health and medical care. Government is involved. Of the total of $20.5 billion that this nation spends on health and medical care each year, 25 per cent of the chit—$5 billion—is picked up by government and paid for out of taxes. To illustrate the mixed economy which characterizes health services in another way, let me remind you that while 60 per cent of all personal medical care expenditures are met out of pocket by the American people, insurance benefits now pay for 18 per cent and tax-supported public expenditures pay for 22 per cent.

With a realistic appraisal of our economic environment, what are the implications for sound public policy? The distinguished Harvard economist, John Kenneth Galbraith, has suggested that the line which divides our area of wealth from our area of poverty is roughly the line which divides privately produced goods and services from publicly rendered services, and that we threaten the stability and integrity of our society unless we maintain a reasonable social balance between the two.

Our ability to maintain a dynamic economy, to attack the remaining sectors of underprivilege, to cope with the mechanics of our complex industrial society, with our exploding and shifting population, and with the changing patterns of human requirements and human resources, depends upon improving this social balance. Many of the services and much of the planning to achieve this can only be furnished within the framework of government.

Therefore, it seems to me that the larger economic and political issue is to assure that in an affluent society the public will not be undernourished. If it is not to be starved financially, taxation must allocate the necessary share of our resources to public services. Neither can we afford a deficit in the intellectual support needed for the imaginative and efficient organization of public services. We need more of what someone has called "organized innovation" in public administration. This is a term used to describe the results of teamwork in scientific research and engineering application. We need more "organized innovation" in public administration, not only in the organization of health services but in many other areas of public responsibility. And there needs to be emphasis on creativity,

imagination—not just the usual team work, the old evaluation technics applied to current problems.

It is this social balance producing enough of the things we need and seeing how we can make a more rational use of our great resources which seems to me to be crucial to the solution of the health problems which confront us today.

Research in Modern Public Health Practice

We in the public health profession stand half-way between the golden age of our past and the dimly visible outlines of a new golden age in the future. The great battles of our past were the battles against the epidemics, and the great heroes of our past were the epidemiologists who first appreciated and then sold to the community the need for crusades against typhoid and smallpox, malnutrition and filth. The battles of this moment are being waged against the modern "plagues" of cancer, heart disease, chronic illness, and mental ill-health. Knowledge of etiology, mechanism, and control of diseases, obtained by modern research is slowly providing the weapons for these battles. The heroes of today are not only those who find the answers, but also those who translate this knowledge into improved health and well-being for all the people. In this way, science and technology in public health will meet the great and exciting challenges of the growing responsibilities of our profession.

"Basic" medical research which constantly penetrates the layers surrounding the core of the nature of disease, is now a familiar part of our national environment, accepted by professionals, the lay public, and public officials. It was not so some 20 years ago. The well defined, well articulated, well supported total national program for scientific investigation is a recent development, attested to by its current economic and political underpinnings.

In a report of the secretary of the Department of Health, Education, and Welfare's Consultants on Medical Research and Education, these figures emerge:

1. Total national research and development expenditures have not only been rising, but rising as a proportion of the gross national production.
2. Total expenditures for research and development in the nation increased from $170 million or 0.2 per cent of the gross national production in 1930 to $10 billion or 2.3 per cent of the gross national production in 1957.
3. The medical component has remained a roughly constant and quite small proportion of the nation's total research and development effort.
4. However, the federal government's share in these funds for support of medical research has grown rapidly and consistently. In 1940 the federal government spent $3 million for medical research, 7 per cent of all medical research expenditures in the nation.

I would like to point out that today the annual appropriation for the National Institutes of Health alone is over $400 million.

In actual dollars the amounts coming from nonfederal sources have continued to increase as well, thereby refuting the claim that federal dollars would "dry up" other sources of support. This growth has been accomplished without significant impairment of the essential freedom of the scientist and his institutes.

To take the fullest advantage of the historical moment in which we are practicing our professions, we must increasingly associate ourselves with those working in the medical and basic research fields. Increases given the National Institutes of Health or National Science Foundation are our own particular and private public health victories. Such victories help us with our jobs. Someone, somewhere, is finding the technics, carving out pieces

for the programs we shall be promoting in future years. We are, indeed, part and parcel of the great research movement of today's world.

But we, as practitioners of public health in its broadest sense, have no adequate answer for the best ways of widely and quickly applying this new knowledge. We are nearest to these problems. We have the data, the experience which can identify them. We must ferret them out. We can be the driving force which brings them to the attention of the research institutions and we must increasingly support, in our own health departments and health organizations, in governmental and nongovernmental services, that spirit of inquiry, of curiosity which identifies or defines the problems, seeks and often finds solutions, attracts top flight investigators, creates "community laboratories" in which research can flower.

There are many unanswered questions about the effectiveness of—and even the continued need for some of our present routine procedures. Mechanisms for organizing and delivering health services are changing even more rapidly than arrangements for paying for medical services. The changing role of the hospital in the community, the notion of progressive patient care, the development of home care and intermediary type facilities, the growing importance of team medicine—these things are but the beginning of what I think will be the very far-reaching results of organized innovations of more creative administration in the health services.

The question is how best to assure that these changes will take place in an orderly and systematic manner, rooted in some logical and deliberate social choices.

This is where "applied research" or "research in public health practice" can provide these answers on a scientific basis. What we need is a coordinated, sustained, and adequately supported effort, similar to that which has been developed for strict medical or "pure" research.

We need centers for research in public health practice in its widest sense. Why can they too not be supported by the Public Health Service and by our great private foundations? We may well need centers devoted to phases of "public health research" similar to that devoted to the study and control of communicable diseases in Atlanta. Why not centers to develop technics of medical care and hospital administration? It is our responsibility as leaders in public health to see that such efforts are initiated and sustained with the same enthusiasm with which our associates—professionals, governmental, and lay—have supported the great basic and medical research programs.

Some beginnings have been made, I am glad to report, in different areas around the country. The New York State Department of Health has for some years had an active research program. Its work in the laboratory field has been outstanding for many, many years. Today, some 25 per cent of its $2 million budget for its Bureau of Laboratories goes to research. Its work at Roswell Park in cancer and its work in chronic diseases are well known. So is Dr. Lester Breslow's work on chronic disease in the State Department of Health in California. And Dr. Albert Hardy's new research unit in the Florida State Health Department warrants close scrutiny. These are important developments of recent years.

In my own department, in the City of New York, our laboratories and services have for many years undertaken research and demonstration projects which added to scientific knowledge and evaluation of services. One has only to remember the work of Biggs and Park, the Astoria School Health Study, to name but a few. In

more recent years we have financed basic research in the fields of immunology, virology, and metabolism in the laboratories of the Public Health Research Institute. But this has not been enough. Five years ago we established an intensified program of research within the city health department itself. We did so because we decided that the development of a research program was fundamental to more efficient operation, and that the health department must be more active in the field. Our organizational structure has been deliberately flexible to include project, staff, and financial arrangements with many types of medical organizations and public and private agencies. In this way, not only have we encouraged and assisted nondepartmental agencies to participate in health research, but we have been able to maintain many times as much research effort as could be handled by our own staff alone, even though the departmental research staff has been considerably enlarged.

We feel that the programs in which researchers have been initiated are directed toward critical evaluation of existing technics and the adoption of new ones to keep pace with the constantly changing health needs and developments.

For example, we are studying such varying subjects as the effect of diet on coronary heart disease, the association of congenital defects with viral disease in pregnancy, the prognostic significance of orthostatic proteinuria, several new technics of immunization and control of amebiasis in mental hospitals. "Program planning" studies are considering the entire problem of such things as rehabilitation needs in New York City or the over-all structure of medical care facilities, public and private. These studies will determine whether some new procedure being tested should be further developed or abandoned.

Two years ago, with the active support of the Mayor, another major research effort was launched. Local funds (currently over $4 million annually) are a part of the budget of the Department of Health. They are administered by an almost entirely autonomic body, the Health Research Council, with representatives of local medical schools, scientific bodies, universities, and the public.

Emphasis has been put on long-time support of the young investigator and holding him in a scientific career. The summer of 1960 has seen some 30 medical students supported in supervised research efforts. Projects in 24 different local institutions are being supported. The areas of interest vary widely—from basic biological and clinical research in many fields to studies of ways to improve outpatient care in hospitals, and the home medical care of welfare recipients, to the evaluation of a small neighborhood approach to the rehabilitation of the narcotic addict.

These activities are the "avante garde" of one health department's attempt to stimulate and help in the research field.

But more, much more, needs to be done if public health in its broader sense is to catch up with the future which is upon us so rapidly in an atomic age. Medical research has become more popular but until there is a greatly expanded and adequately supported effort in applied research in the health field, there will continue to be long and unnecessary lags in putting into widespread practice the lessons learned from our other medical and scientific research colleagues. These lags will cost many lives and waste millions of dollars.

In conclusion, I would like to mention a concern I have that has very little to do with economics, politics, basic or applied research, but a great deal to do with people. With our increasing professionalization, our talk of "struc-

turing," "crash" programs, evaluation, basic research, line and staff functions, the team approach, and so forth, I sometimes fear that as we gather volumes of statistics about people's motivations and behavior, as we mechanize our records and our diagnostic technics, as we learn more of basic mechanisms in the causation of disease, we may lose sight of the people themselves. We may miss the most obvious lesson because we are training the youngsters in our profession too much to respect the statistics, the gathering of facts, and too little to respect the people.

If we fail to array our accumulating statistics and discoveries around values that place human dignity at the core of all endeavors, we may some day be forced to ask ourselves, in the words of T. S. Eliot, "Where is the wisdom we have lost in knowledge?"

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Job-Title Changes for Illinois

Effective August 1, division head titles in the Illinois Department of Public Health were changed. The title of "chief" is now being used for all division and bureau heads. Formerly division heads have carried the title of deputy director. There is now only one deputy director, R. F. Sondag, M.D., M.P.H. His former title of assistant director will be vacated.

With any preparation of multiple antigens, a basic question is the possibility of immunologic interference or enhancement. This paper reports a study on 48 infants from two to four months of age who received a multiple vaccine against diphtheria, tetanus, pertussis, and poliomyelitis. Maternal antibodies, when present, appeared to suppress both the primary and booster response to the several antigenic components.

SEROLOGIC RESPONSE OF INFANTS TO A MULTIPLE VACCINE FOR SIMULTANEOUS IMMUNIZATION AGAINST DIPHTHERIA, PERTUSSIS, TETANUS, AND POLIOMYELITIS, IN RELATION TO THE PRESENCE OF SPECIFIC MATERNAL ANTIBODY

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THERE ARE obvious advantages in the use of a preparation of multiple antigens for simultaneous immunization against several diseases. Decreasing the number of injections, for example, becomes an important objective with the ever-increasing number of specific antigens available for active immunization; it is important, too, in relation to the current emphasis on early immunization of infants. A growing number of combined prophylactics have been suggested, and some have been subjected to field study. Triple vaccine containing diphtheria and tetanus toxoids and pertussis vaccine (DPT) has been in common use in the United States for a number of years; and recently, studies have been directed towards the inclusion of poliomyelitis antigens to make a quadruple vaccine (DPT-polio) for simultaneous immunization against all four diseases.

While the triple antigen has been used on a large scale with apparent success, the inclusion of poliomyelitis vaccine (Types I, II, and III) with the other three antigens, introduces new factors in the manufacture of the resulting multiple vaccine, and it must be evaluated as a new product. A basic question which needs examination, as with any preparation of multiple antigens, concerns the possibility of immunologic interference or enhancement. That is, does any one of the several antigens interfere with the immunologic response to any of the others, or, is the

response of any one enhanced by combination with the others? The question also arises whether the presence of specific antibody—actively produced, or passively acquired by the infant as maternal antibody—either increases or suppresses the immunologic response. In experiments in animals, using a combination of DPT and polio vaccine, Kendrick and Brown[1] observed that there was a serologic response to each component; in monkeys, there was some indication of enhancement of the response to poliomyelitis antigens in the combined product in comparison with poliomyelitis vaccine given alone. Schuchardt, Munoz, and Verwey[2] compared triple with quadruple vaccine in potency tests in animals and observed that with the two products the results were similar for diphtheria and tetanus toxoids and for the pertussis component; in monkeys, the potency of the poliomyelitis component was greater with the quadruple than with poliomyelitis vaccine alone except in the instance of Type I which they pointed out was a weak antigen.

For immunization of children, Batson, et al.,[3] mixed poliomyelitis vaccine with pertussis vaccine and also with triple vaccine in the syringe used for injection and observed no interference among the several antigenic components; neither did they observe any influence of maternal antibodies on the response. Barrett and co-workers[4,5] injected children from two and a half months to five years of age with the product Quadrigen* in which the four antigenic components were combined during manufacture. These authors found that the antibody levels following the primary immunization series were not as high in infants of less than six months as in older children. They stated that the presence of maternal antibody made the results more difficult to evaluate and concluded that the response to a booster injection is a more meaningful criterion for evaluating the effectiveness of vaccine than the primary response.

The official release of multiple antigen preparations containing diptheria and tetanus toxoids and pertussis and poliomyelitis vaccines for use in the United States and in Canada, and the recommendation of such preparations by the Multiple Antigens Committee of the American Public Health Association,[6] emphasize the importance of the accumulation of as much basic information as possible on the use of these products. In this paper, the data are concerned particularly with the effect of passively acquired maternal antibody on the infant's response to the several component antigens.

Plan of Study

The clinical portion of this study was undertaken by Drs. Watson and Giammona, Department of Pediatrics, University of Michigan Medical School, who are reporting these aspects elsewhere.[7]

Forty-eight healthy infants who were registered at the Well Baby Clinic of the University of Michigan Hospital were from two to four months of age at the time of their first injection with 0.5 ml of a multiple vaccine† containing diphtheria, tetanus, pertussis, and trivalent poliomyelitis antigens (DPT-polio). Second and third injections of 0.5 ml each were given at intervals of one month. Thirty-one of the children received a fourth or booster dose of the same material, most of them from six to eight months later, a few after a year. Blood specimens were obtained from all 48 children at the start of the study and again two weeks after the

* Trade name, Parke, Davis & Company.

† The vaccine (Quadrigen) was kindly supplied by its manufacturers, Parke, Davis and Company, who also supported financially the clinical portion of the study.

primary series of injections. Prebooster specimens were obtained from only five of those receiving the additional injection but all 31 were bled from three to four weeks following it. The sera were maintained at 4°C until tested.

Laboratory Methods and Results

Diphtheria and Tetanus

The diphtheria and tetanus antitoxin levels were determined in the laboratories of Parke, Davis and Company, Detroit. Serum specimens for these tests were available on 42 of the 48 infants. The antitoxin levels have been grouped in terms of units as shown in Table 1. It will be seen that 31 of the 42 infants tested for diphtheria antitoxin had prevaccination levels of less than to the diphtheria, tetanus, and munization, 28 of these showed an increase to levels of between 0.1 and one unit and two had increased to more than one but less than 10 units. Of the 11 infants with preimmunization levels between 0.1 and one unit only two showed an increase following the primary series.

Thirty-seven of the 42 infants tested for tetanus antitoxin had preimmunization levels of less than 0.1 unit. All showed an increased level and most of them had more than one unit following vaccination. Of the five infants with detectable levels prior to immunization, two showed an increase.

Postbooster diphtheria and tetanus antitoxin levels were available for only 19 of the 42 infants. Thirteen and 17 of these, respectively, had less than 0.1 unit of diphtheria and tetanus antitoxin prior to primary vaccination; and after the booster injection, all showed a further increase over the postprimary level. Only 6 of the 19 infants had detectable diphtheria antitoxin before primary vaccination; following booster, three remained at the same level, and three increased. The two infants with detectable tetanus antitoxin before vaccine showed increased levels following booster.

Pertussis

Pre- and postprimary vaccination specimens from 47 of the 48 infants were tested for serologic response to the pertussis component of the quadruple vaccine, in terms of specific agglutination, using a rapid, reduced volume procedure.[8] Briefly, 0.1 ml of each serum dilution was mixed with 0.1 ml of a killed suspension of B. pertussis of 20 opacity units by NIH standard, the mixtures were shaken for three minutes, salt solution added, the tests read, and the results expressed in reciprocal titers of the highest final serum dilution at

Table 1—Diphtheria and Tetanus Antitoxin Levels in the Sera of 42 Infants Before and Following Vaccination with DPT-Polio

	Number of Infants at Each Level of Antitoxin					
	Prevaccination		Postvaccination			
	Units	Numbers	<0.1	0.1 to 1.0	1 to 10	>10
Diphtheria	<0.1	31	1	28	2	
	0.1 to 1.0	11	2	7	2	
Tetanus	<0.1	37		2	28	7
	0.1 to 1.0	3		2	1	
	>1 to 10	2	1			1

Table 2—Pertussis Agglutinin Titers in 47 Infants Before and Following Vaccination with DPT-Polio

Prevaccination		Postvaccination Titers			
		Number of Infants in Each Range			Geometric
Titers	Number	Negative	4-16	32-128	Mean
Negative	43	14	13	16	10.35
16	1	1	0	0	Negative
32	3	1	2	0	4.00

which definite agglutination was observed.*

In Table 2, the results with postvaccination sera have been arranged according to the titers of samples taken before vaccination. Of 43 infants without demonstrable prevaccination antibodies, 14 (approximately one-third) remained negative—a lower response than would be expected following a strongly antigenic vaccine. There were only 4 of the 47 infants who had positive agglutination tests before vaccination, that is, who had measurable maternal antibody in their serum; and all four had lower titers after primary vaccination than before. This suggests that there had been progressive elimination of maternal antibody without active serologic response of the infant. The question immediately arises as to whether the apparent depressive effect of circulating maternal antibody on postprimary response would still be observed after a later booster injection. In Table 3, the postprimary and postbooster results in 30 infants suggest that the increased titer expected in a secondary response was obtained only in those infants without detectable agglutination before vaccination. In the four infants with measurable prevaccination antibodies the postprimary titers showed a decrease; and the response was still depressed after the booster injection six months later. The preprimary, postprimary, and post booster titers of these four infants were, respectively: 32, 8, 4; 16, 4, 8; 32, 4, 4; 32, 4, 4. The numbers are small and do not warrant firm conclusions, but the results are consistent with the hypothesis that the presence of maternal antibody depressed the serologic response of the infant to primary vaccination, and also that this depressive effect may still be present after a booster injection six months later. The effect of a still later booster injection under these conditions was not studied.

* As explained elsewhere,[9] if these titers are to be compared with those obtained in the one-ml volume tests, the titers obtained in the rapid test should be multiplied by five, in order to assure comparison of reactions between equivalent amounts of serum and antigen.

Poliomyelitis

Poliomyelitis antibody levels were determined by performing neutralization tests against standard strains of the three types of virus in plastic panel tissue cultures of monkey kidney cells.[10] Pre- and postvaccination sera were available for all 48 infants and were always tested together on the same day. Antibody titers are expressed in terms of the reciprocal of the highest original serum dilution which neutralized 100 tissue culture doses of virus. Since most of the mothers had received poliomyelitis vaccine during pregnancy or within the two years preceding, many of their infants had detectable antibodies at the

time they received the first injection. As indicated in Table 4, only 18 had no detectable antibodies to Type I virus at the lowest dilution tested (1:4), ten were negative for Type II, and 22 for Type III. Only four were "triple negative." The geometric mean antibody titers of the prevaccination specimens were 7, 19, and 7 for Types I, II, and III, respectively. The postprimary vaccine mean titers for the same three types were 7, 24, and 22, indicating that except for Type III very little antibody development had been induced by the vaccine. However, examination of the postprimary vaccination titers in relation to their corresponding prevaccination titers reveals a startling fact. Of the 18 negative for Type I before vaccination, seven developed antibodies, as did nine of ten negative for Type II, and 18 of 22 for Type III. In contrast, only 5 of the 30 with prevaccination antibodies to Type I, 8 of 38 for Type II, and 7 of 26 for Type III showed a rise in antibody titer after primary vaccination! Furthermore, most of the infants with prevaccine antibodies that showed a subsequent rise in titer had very low titers (either four or eight) before immunization. When the prevaccine titers were 16 or greater, the titers of the vast majority of them decreased following the three injections, many to such an extent that antibodies were no longer detectable. In some children the titers of antibody to the three types varied independently of each other; the titer of antibodies for two types might decrease while the titers of a third would develop following vaccine, particularly if not present in the prevaccine specimen. Two examples of this phenomenon are shown:

	R.H.		
	I	II	III
Prevaccine	16	<4	64
Postprimary	<4	8	<4
Postbooster	<4	256	<4

	S.K.		
	I	II	III
Prevaccine	<4	256	<4
Postprimary	256	256	1024
Postbooster	256	8	1024

These results suggest strongly that passively transferred maternal antibodies, if present in titers of 1:16 or greater, interfere with the response to active immunization with poliomyelitis vaccine.

In Table 5, the results for the 31 infants who received booster injections from six months to one year following the third dose of the primary series were arranged according to those infants with maternal antibodies (by type) at the time of their first injection, and those without antibodies. The prevaccination geometric mean titers of those with maternal antibodies were 24, 35, and 22 for Types I, II, and III, respectively. The mean titers of these same indi-

Table 3—Pertussis Agglutinin Titers in the Sera of 30 Infants Before and Following Primary and Postbooster Vaccination with DPT-Polio

Prevaccination		Postprimary				Postbooster			
Titer	Number	Negative at 1:4	4-16	32-128	Geometric Mean	Negative at 1:4	4-16	32-128	Geometric mean
Negative	26	7	7	12	10.44	0	11	15	23.87
16	1	1	0	0	Negative	0	1	0	8.0
32	3	1	2	0	4.0	2	1	0	2.57
Total	30	9	9	12		2	13	15	

Table 4—Effect of Vaccination with DPT-Polio on Poliomyelitis Neutralizing Antibody Titers in the Sera of 48 Infants

Type	Prevaccination Titer	Prevaccination Number	Postvaccination Increase	Postvaccination Same	Postvaccination Decrease
I	<4	18	(7)	11	—
	4-8	9	(4)	1	4
	16-64	20	1	1	(18)
	>64	1	0	0	1
II	<4	10	(9)	1	—
	4-8	7	(6)	0	1
	16-64	22	2	4	(16)
	>64	9	0	1	(8)
III	<4	22	(18)	4	—
	4-8	12	(6)	0	6
	16-64	13	1	2	(10)
	>64	1	0	0	(1)
All types	Negative	50	(34)	16	—
	4-8	28	(16)	1	11
	16-64	55	4	7	(44)
	>64	11	0	1	(10)

NOTE: numbers in parentheses are for special emphasis.

viduals were only 4, 17, and 12 following the primary series and an additional booster injection six months later. In contrast, the postbooster means of those with no detectable antibody before vaccination were 27, 161, and 268 for the three types, respectively. It will be seen that of eight infants with no detectable antibodies to Type I virus before vaccination, five were still in the <4 category after the primary series; all but one, however, had developed antibodies as a result of the booster injection. In contrast, of 17 infants with prevaccination titers of 16 or 64, most were lower in titer following primary and 11 were <4 following the booster injection. This pattern of antibody titer shift is essentially the same for all three types. Thus it is clear that the presence of maternal antibodies inhibited not only the primary response, but, under the cover of maternal antibodies in high titer, vaccine did not condition the infants to the booster phenomenon. This is further illustrated in Table 6, which shows the results of all tests on the only five infants who were bled immediately prior to the booster injection.

Discussion

It was not the primary purpose of this study to measure the efficacy of the multiple vaccine or to investigate the antigenicity of its individual components in comparison with the same antigens given separately. By the strictest of the requirements for measurement of antigenicity of a vaccine, namely, the response of children with no detectable specific antibodies before vaccination, the components measured up well. In fact, the conversion of "negatives" to "positives," in terms of antibody was very good for the diphtheria and tetanus but was somewhat less than expected for the pertussis and poliomyelitis. Nor is it the purpose of the study

to interpret serological responses in terms of actual protection against given diseases. It is recognized that measurable antibodies, especially those determined by neutralization tests, provide an index of probable protection, but immunity can exist in the absence of detectable antibodies. Conversely, the presence of antibodies in high titer is no guarantee of absolute protection against invasion and infection with any of these agents.

Granted, then, that immunity is relative, the investigator should be concerned with any factor which interferes with the development of antibodies following experience with an antigen. One such factor appears to be evident in this study, namely, the suppressive effect of maternal antibodies on the antibody response of infants to vaccination. Although only a small number of infants had persisting maternally acquired antibodies to diphtheria, tetanus, and pertussis the data were sufficient to illustrate this phenomenon. The vaccine was successful in stimulating an increase in measurable antibody in only 2 of 11 such infants with diphtheria antibodies, two of five with tetanus, and none of four with pertussis agglutinins before vaccine. These results are entirely in keeping with the more extensive data observed in the study of poliomyelitis antibody response. Due to the recent vaccination of most of the mothers against this disease a very high proportion of the infants had high levels of maternal antibody at delivery. Thirty of 48 had demonstrable antibodies for Type I, 38 for Type II, and 26 for Type III. As mentioned previously only four infants failed to show antibodies for at least one type of virus. Only 16 per cent, 21 per cent, and 26 per cent of the infants with antibodies showed an increased titer to the three types, respectively, following vaccination. Perhaps more pertinent to the question of suppression is the fact that antibody titers actually decreased in the majority of such infants. This was true of pertussis as well as poliomyelitis and to a lesser extent of diphtheria and tetanus.

Suppression of active immunization by passive antibodies is not newly recognized. Talmage[11] states that transfer of serum from an immunized to a normal animal has been shown to suppress rather than accentuate the sub-

Table 5—Poliomyelitis Neutralizing Antibody Titers in the Sera of 31 Infants Before and Following Primary and Postbooster Vaccination

	Prevaccination		Postprimary							Postbooster						
Type	Titer	No.	<4	4	8	16	64	256	1,024	<4	4	8	16	64	256	1,024
I	<4	8	5		1		1	1		1	2	1		2	1	1
	4-8	5	2	1	1	1				2			1	2		
	16-64	17	6	2	4	5				11	2	3	1			
	>64	1					1			1						
II	<4	6	1		1	1	1	1	1					3	2	1
	4-8	6	1		1	1	2	1		1		1		1	3	
	16-64	14	3	2	4	4	1			3	1		4	4	2	
	>64	5		1			3			2	2	1				
III	<4	15	1		3	2	1	6	2	1				4	3	7
	4-8	6	2	1		1	2			1				3	2	
	16-64	9	4	1		3	1			6	1		1		1	
	>64	1					1				1					

Table 6—Individual Poliomyelitis Neutralizing Antibody Titers of Five Infants by Type

Serum Specimen	J.C.			R.N.			N.J.			J.R.			T.W.		
	I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
Preprimary	64	8	16	4	64	<4	16	8	64	8	64	4	8	8	<4
Postprimary	<4	<4	<4	<4	16	<4	<4	16	4	<4	8	<4	16	64	16
Prebooster	<4	<16	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	4	<4	<4
Postbooster	8	64	16	64	<4	64	<4	256	<4	16	16	64	64	8	64

sequent antibody response. di Sant' Agnese[12] found that newborn children did not respond as well as older children to diphtheria immunization but observed that this condition was corrected following a booster dose. However, he added that the final response was better when the booster was given a year later rather than after six months. Additional examples of this phenomenon are cited by Edsall[13] in a recent review. The inferior response of young infants to poliomyelitis vaccine has been observed recently by several authors.[4,5,14-19] Some of these authors associated this inhibition with the presence of maternally transferred passive antibodies.[15-20] Since there is ample evidence that older children and adults with actively produced antibodies respond well to vaccination, the obvious conclusion is that the difference which exists between the two types of response is not related to the presence or absence of antibodies per se, but to whether they were passively acquired or actively produced by the individual himself. In the latter case the antibody forming mechanism has been activated by either natural exposure or previous vaccination and additional stimuli are therefore capable of enhancing the output of antibodies.

In the case of passively acquired circulating antibodies, no host mechanism is operating and the combination of antibody with antigen may represent the phenomenon of the neutralization test in vivo. This theory is supported by the present data which show that interference with active immunization is more likely to occur in the presence of higher concentrations (titer of 1:16 or higher) of passively acquired antibodies. A previous study[21] has shown that children respond very well to poliomyelitis vaccine administered three days following gamma globulin in double the usual prophylactic dose. This amount of gamma globulin, however, was shown to be detectable only in very low titer (1:2 or 1:4) in the circulating blood and for a limited time not exceeding three weeks.[22] The titer of passive maternal antibodies acquired by the infant can be very high depending upon the level in its mother, and can persist for many months.[17] Thus the level of mother's antibodies appears to be the governing factor in the serologic response of her infant to vaccine.

In a study beginning in 1954, poliomyelitis vaccine was reported to be reasonably effective in stimulating antibodies in two- to four-month-old infants.[23] Very few of the babies had antibodies at this age since the practice of routine vaccination of pregnant women had not yet been inaugurated. During recent years, however, many more women have poliomyelitis antibodies at the same time of delivery. Since it has been shown that the poliomyelitis antibody titer of mother's blood and cord blood are very similar,[23,24,14] and of mother's blood, cord, and new-

born infant's blood,[17] and since persistence of these passive antibodies in babies is a function of the original titer,[23,17,14,25] it seems clear that interference with active immunization of the infant is becoming more rather than less of a problem. This is illustrated by the findings in a study undertaken in 1956 in which 30 per cent of unvaccinated and 71 per cent of vaccinated women had antibodies for all three types of poliomyelitis virus at the time of delivery.[17] In a survey made in 1958, 83 per cent of 100 pregnant women, most of them recently vaccinated, had antibodies to all three types of virus.[26]

This increasing incidence of maternal antibodies is reflected in the present study where over 90 per cent of the infants had antibodies for one or more types three months following birth. A similar study in Canada by Wilson, et al.,[19] reports that less than 50 per cent of their infants had maternal antibody to poliomyelitis before vaccination; however, over one-third of them were five months of age or older, which may explain the better serological response to multiple vaccine found in their study in comparison with the present data.

The concern for possible inhibition of poliomyelitis antibody production in infants does not apply equally to the response to the diphtheria, tetanus, and pertussis components, since few of the mothers had detectable antibodies to these diseases as reflected by the prevaccination testing of their infants in the present study. In the 1956 report mentioned above only 5 of 95 mothers had pertussis agglutinins at the time of delivery, and in the 1958 survey, 15 of 100 were positive.

In view of the data presented it would seem that there should be serious consideration of delaying poliomyelitis vaccination of infants until maternal antibodies are more likely to be gone or at least reduced to a low level. The child is less frequently exposed early in infancy, and furthermore he should be protected during this interim by the same passively acquired antibodies which suppress the response to vaccine. Such a delay in administration would not necessarily preclude the combination of poliomyelitis vaccine with "triple" vaccine since perhaps it, too, could be delayed without serious consequences.

Summary

Forty-eight infants from two to four months of age were injected three times at intervals of one month with 0.5 ml of a multiple vaccine against diphtheria, tetanus, pertussis, and poliomyelitis. Thirty-one of the children received an additional or booster dose from 6 to 12 months later.

Serologic tests on prevaccination blood specimens revealed that very few of the infants had detectable antibodies to diphtheria, tetanus, or pertussis, but the majority of them had poliomyelitis antibodies at this time.

The response of the majority of the infants to the poliomyelitis components of the vaccine was definitely poorer than to the diphtheria, tetanus, and pertussis components.

The lower serologic response to the poliomyelitis antigens was clearly associated with the presence of maternally acquired passive antibodies in the infant's serum at the time of vaccination. The few children who had prevaccination antibodies to diphtheria, tetanus, and pertussis also had poorer response than did those who were negative before vaccination.

The suppressive effect of maternal antibodies affected not only the primary, but also the booster response to the several antigenic components; tetanus antibody production seemed to be least influenced. The significance of the findings is discussed.

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In 1958, a newly described agent of encephalitis, Powassan virus, was isolated in Canada. Serological surveys of residents of northern Ontario showed that 3 per cent of those tested had neutralizing antibody to this virus, indicating past subclinical infection. Presence of neutralizing antibody in chipmunks and squirrels in this area suggests that these rodents may be natural reservoirs of infection.

POWASSAN VIRUS: SURVEYS OF HUMAN AND ANIMAL SERA

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ALTHOUGH THE ARTHROPOD-BORNE viral encephalitides[1] have presented public health problems in many areas of western United States[2] and Canada[3] over the past three decades, their occurrence in eastern North America has been less frequent and their distribution was confined mainly to the eastern seaboard, from Texas to Massachusetts.[2] In Montreal during 1957, a child who developed encephalitis showed serological evidence of infection with western equine encephalomyelitis virus.[4] In 1958, a newly described agent, Powassan virus,[5] was isolated from the brain of a child dying of encephalitis who lived at Powassan, Ontario.

Powassan virus behaves as a member of Casals' group B of the arthropod-borne viruses.[6] In complement-fixation and hemagglutination inhibition tests, it showed fairly close antigenic relationship to Russian spring-summer encephalitis (RSSE) virus.[7] Although this relationship was also evident on neutralization tests, the viruses were distinct from each other. In addition, Powassan virus gave comparatively weak cross-reactions with St. Louis encephalitis virus, which is the only other group B arthropod-borne virus known to infect man in North America.

On account of this antigenic relationship between Powassan virus, and RSSE virus which is known to be transmitted by ixodid ticks,[8,9] it was considered likely that ticks may also be vectors of Powassan virus. Since ground squirrels and to a lesser extent chipmunks[10] are important natural reservoirs of Colorado Tick fever, the only arthropod-borne virus disease in North America which is known to be transmitted by ticks,[11] it was considered that forest rodents may also be reservoirs of Powassan virus. It should be emphasized that the vector of Powassan virus is at present unknown and, consequently, possible vectors including ticks and mosquitoes were investigated.

Methods and Materials

Serological surveys of healthy residents of several northern Ontario communities were carried out through the kind cooperation of Dr. J. E. Dillane, Powassan, and Dr. P. N. Karnauchow, North Bay.

Neutralization and complement-fixation tests were performed on all human sera received, according to methods described previously.[5] In neutralization tests, unheated sera (0.15 ml aliquots) were mixed with equal quantities of Powassan virus diluted to give 50 mouse LD_{50} per 0.03 ml of serum-virus mixture. After standing for one hour at room temperature, 0.03 ml aliquots were inoculated intracerebrally into groups of five mice each aged three weeks. Sera which neutralized 50 LD_{50} or more of virus were considered positive. Complement-fixation tests were performed in plastic hemagglutination plates using as antigens borate-saline extracts of infected suckling mouse brain. Antigens prepared from Powassan, St. Louis encephalitis, eastern equine and western equine encephalomyelitis viruses were used at their optimal dilutions which were determined in preliminary "box" titrations with their homologous antisera in the presence of two complete hemolytic units of complement.

In northern Ontario, mammals, excepting farm animals, and birds, excepting those from Algonquin Park, were obtained by shooting. Upon retrieving the specimen, the chest was opened and blood was pipetted out. After holding the blood overnight at 4° C, the serum was separated and transported to the Toronto laboratory at 4° C in a vacuum flask. In the laboratory, blood was obtained from hamsters and chickens by cardiac puncture. Blood from farm animals was obtained by venipuncture.

Ticks were sought along roadways and on the forest floor by dragging with flannelette flags two feet square. In addition, all animals shot in the field were placed in canvas bags. An examination for ticks and other ectoparasites was conducted the following morning.

Mosquitoes were captured while feeding on human beings by means of a sucking tube. They were held at room temperature and fed on an aqueous solution of sucrose until tested. For injection experiments, mosquitoes were anesthetized with CO_2 and injected using a finely drawn hard glass pipette as described previously.[12]

Table 1—Incidence of Neutralizing Antibody in Human Residents of Northern Ontario

Locality	Number Positive	Number Tested
Powassan	1	6
North Bay	2	65
Manitoulin Island	3	52
Sault Ste. Marie	0	57

Results

Sera obtained from 180 healthy residents of northern Ontario between April and August, 1959, were examined for antibody to Powassan virus (Table 1). Of six healthy family contacts of the Powassan index case described previously,[5] one had neutralizing and complement-fixing antibody to Powassan virus. This person and three other contacts who did not have antibody used to participate frequently with the index case in skinning chipmunks and squirrels which they had shot in forests adjacent to the homestead. The other two family contacts were not exposed to forest fauna.

Neutralizing antibody to Powassan virus was detected in sera of two persons out of 65 who lived in the North

Bay district. Sera from three residents of Manitoulin Island out of 52 tested contained antibody. However, no antibody was detected in sera donated by 57 residents of Sault Ste. Marie. None of these sera contained complement-fixing antibodies against Powassan, St. Louis, eastern equine or western equine encephalitis antigens. This suggests that foci of infection with Powassan virus exist in Powassan extending northwards to North Bay, and on Manitoulin Island.

During August and September, 1959, we examined sera from 28 wild and six domestic mammals, 12 wild birds and two domestic fowl, in the Powassan area, and from five wild birds including one ruffed grouse (Bonasa umbellus) and one squirrel on Manitoulin Island for evidence of neutralizing antibody to Powassan virus. Through the courtesy of Dr. A. M. Fallis, Ontario Research Foundation, sera from 11 wild birds which were kept in Algonquin Park during the summer of 1958 or 1959 were tested for Powassan antibody.

Neutralizing antibody was detected in sera of four chipmunks (Tamias striatus) out of 13 examined from the Powassan area (Table 2). Antibody was detected in the serum of one squirrel (Tamasciurus hudsonicus) from the Powassan district out of nine examined, but antibody was not detected in four mice (Peromyscus maniculatus); two snow-shoe rabbits (Lepus americanus); two horses, two cows, two dogs, and two fowl on the farm at which the index case resided; or in 17 birds mainly finches and sparrows near Powassan and on Manitoulin Island. All 11 Algonquin Park birds comprising five ruffed grouse, one spruce grouse (Canachites canadensis), three grackles (Quiscalus versicolor), and two Canada jays (Perisoreus canadensis) gave negative results in a neutralization test.

Table 2—Incidence of Neutralizing Antibody in Mammalian and Avian Sera

Locality	Species	Number Positive	Number Tested
Powassan	Chipmunk	4	13
	Squirrel	1	9
	Field mouse	0	4
	Rabbit	0	2
	Farm mammal	0	6
	Bird	0	14
Manitoulin Island	Squirrel	0	1
	Bird	0	5
Algonquin Park	Bird	0	11

These results show that chipmunks and squirrels are likely reservoirs of Powassan virus in nature. The absence of antibody in sera of 30 birds tested so far renders unlikely the possible role of birds as reservoirs of infection. Final assessment of this role of birds as reservoirs will await the result of tests on further bird sera.

All rodents and birds shot in the field were examined closely for ectoparasites. No ticks were found on ground game or birds, but Haemaphysalis leporis-palustris larvae, nymphs, and adult ticks were found on two rabbits taken near Powassan. Apart from occasional fleas which were found on some chipmunks and mites on one mouse, no blood-sucking ectoparasites were found either on animals or on the ground.

Pools of approximately 50 ticks were ground in chilled mortars and extracted with 10 per cent ox serum saline containing antibiotics. The clear supernatant following centrifugation at 1,500 RPM for five minutes was injected intracerebrally into groups of nine newborn mice. Virus was not isolated from any of four pools examined.

Aedes spp. mosquitoes were collected

Table 3—Response of Chickens to Subcutaneous Injection with Powassan Virus

Virus Dose Mouse LD_{50}	Viremia Days After Injection						Antibody 23 Days
	1	3	4	5	7	9	
1	0/3*	8/10	3/3	6/6	6/7	0/4	4/6
10	0/3	9/9	3/3	6/6	4/6	2/3	4/5
100	1/2	4/4	3/3	4/4	1/1	n.t.*	2/3

* Numerator: Number of chickens with viremia or antibody.
Denominator: Number of chickens tested.
n.t.: Not tested.

while attempting to feed on the investigators in a forest five miles east of Powassan during early September, 1959. No virus was isolated by inoculation of newborn mice with an extract of approximately 50 mosquitoes in ox serum saline.

Groups of two-day old chickens were inoculated subcutaneously with 1, 10, and 100 mouse LD_{50} of Powassan virus. Blood was obtained by cardiac puncture at intervals after inoculation. Blood was diluted 1:3 in sterile Alsevers' solution. Its virus content was titrated by intracerebral injection of three-week old mice in groups of five. Each mouse received 0.03 ml of serial tenfold dilutions of citrated blood in ox serum saline.

Viremia was detected in virtually all chickens between the third and seventh days after inoculation (Table 3). However, few chickens were circulating virus when bled on the first or ninth days after inoculation. Maximum titers of viremia ($10^{5.0}$ mouse LD_{50} per 0.03 ml) were attained on the third and fourth days but they fell to titers of $10^{1.5}$ on the seventh day. The titers of viremia was independent of the virus dose administered. Thus the recently hatched chicken was as sensitive an indicator of virus in a seed lot as the weaned mouse inoculated intracerebrally. Antibody which neutralized to 50 LD_{50} or more of Powassan virus was detected in sera of most birds when bled 23 days after inoculation. At no time did any chicken develop signs of encephalitis.

Viremia was produced in hamsters regularly on the second, fourth, and fifth days after subcutaneous injection of 10^4 mouse LD_{50} of Powassan virus, but viremia was not detected six or eight days after inoculation (Table 4). However, of six hamsters which received merely 10 LD_{50} of virus, only three had viremia when tested four, five, or six days after inoculation.

Two laboratory rabbits were injected subcutaneously with 10^4 mouse LD_{50} of Powassan virus. One rabbit produced a low titer viremia four days after inoculation. Neutralizing antibody was detected in sera of both animals when tested 14 days after inoculation.

Culex fatigans mosquitoes captured near Toronto were injected with 10^3 mouse LD_{50} of Powassan virus. Although most mosquitoes contained virus immediately after injection, none was detected in two mosquitoes which were tested after being held at 80° F for four days, nor in a further two mosquitoes which were tested after seven days of extrinsic incubation.

Discussion

Isolation of Powassan virus, a group B member of the arthropod-borne

viruses, from the brain of a child who succumbed to encephalitis during September, 1958,[5] stimulated investigations of possible natural reservoirs and vectors. Following subcutaneous injection of small doses of Powassan virus in the laboratory, young chickens and hamsters produced a transient, asymptomatic viremia. The titer and duration of viremia of Powassan virus in two-day old chickens approximated closely the results of St. Louis encephalitis virus in 0.5-day-old chickens[13] or Murray Valley encephalitis virus in two-day-old chickens.[14] Production of neutralizing antibody followed the disappearance of viremia in the case of each virus. It is possible that forest rodents and birds react similarly to injection of small doses of Powassan virus by syringe or by the bite of an infected arthropod. Since neutralizing antibody was detected in sera obtained from four chipmunks and one squirrel near Powassan, it seems likely that these rodents may be natural reservoirs of infection.

The mechanism of transfer of infection from natural reservoirs to man remains an enigma. Ixodid ticks which bite man such as Dermacentor variablis are seen by local residents most infrequently. During the summer of 1959, the only ixodid ticks found by us were Haemaphysalis leporis-palustris, and these infested two rabbits which were shot. These rabbits did not circulate Powassan antibody. Only rarely do these ticks bite man, and they have not so far been found on chipmunks or squirrels. The low rate of inapparent infection amongst the local human population is in favor of a vector which bites man occasionally. It is possible that Haemaphysalis ticks may perpetuate a rodent-tick-rodent cycle in the same manner as Haemaphysalis spinigera ticks are vectors of Kyasanur Forest disease virus among forest primates and rodents in India.[15] Since our index case at Powassan was exposed to ground game repeatedly, it is conceivable that he may have become infected by the bite of a vector which alighted from a recently captured rodent.

It seems unlikely that culicine mosquitoes may act as vectors of Powassan virus. Virus was not isolated from mosquitoes captured near Powassan. Mosquitoes were not abundant during late summer at which time the case of encephalitis occurred. Virus did not multiply following injection into the body cavity of mosquitoes, unlike Murray Valley encephalitis[12] or other mosquito-borne viruses. Furthermore the close serological relationship which exists between Powassan virus and RSSE virus which is transmitted by ticks and not by mosquitoes favors ticks rather than mosquitoes as vectors of Powassan virus.

Table 4—Response of Hamsters to Subcutaneous Injection with Powassan Virus

Virus Dose Mouse LD_{50}	Viremia Days After Injection					Antibody 23 Days		
	2	4	5	6	8	14	17	36
10	0/3*	1/3	1/3	2/3	0/6	1/1	2/2	2/2
10^4	3/3	3/3	3/3	0/2	0/6	1/1	2/2	2/2

* Numerator: Number of hamsters with viremia or antibody.
Denominator: Number of hamsters tested.

Summary

In serological surveys of residents of northern Ontario, 3 per cent of persons tested had neutralizing antibody to Powassan virus, which indicates past subclinical infection with this virus. The presence of neutralizing antibody in four out of 13 chipmunks and one out of ten squirrels captured in these districts suggests that these rodents may be natural reservoirs of infection.

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If the enterococci or fecal streptococci are to be used to determine the sanitary quality of water, more information is needed on the species or types present in human feces, in different animals, in sewage and contaminated water. The studies reported below are intended to supply this need, in part. Furthermore, the authors comment on the usefulness of these organisms as sanitary indicators.

TYPES AND SANITARY SIGNIFICANCE OF FECAL STREPTOCOCCI ISOLATED FROM FECES, SEWAGE, AND WATER

Clara H. Bartley, Ph.D., and Lawrence W. Slanetz, Ph.D., F.A.P.H.A.

WITH THE DEVELOPMENT of improved technics for the detection of enterococci or fecal streptococci in water, there has been a renewed and increasing interest in the use of these organisms to indicate water contamination. These bacteria can now be efficiently and accurately enumerated in water samples by membrane filter technics using a highly selective medium. Their use as indicators of water pollution would eliminate the question of fecal or nonfecal origin that now exists when tests for coliforms are employed. If fecal streptococci are present in water in detectable numbers, this definitely indicates fecal contamination from human or animal sources.

If the enterococci are to replace, or are to be used in conjunction with coliform organisms for determining the sanitary quality of water, more information is needed as to the species or types present in feces of human beings and different animals and in sewage and contaminated water. Information on the viability of these organisms in water as compared to coliforms would also be of interest.

In "Bergey's Manual of Determinative Bacteriology,"[1] the enterococci are classified as Streptococcus faecalis, Streptococcus faecalis var. liquefaciens, Streptococcus faecalis var. zymogenes, and Streptococcus durans. These are the fecal streptococci that will grow at a pH of 9.6, at temperatures of 10° and 45° C, grow in 6.5 per cent NaCl broth, in 0.1 per cent methylene blue milk and survive at 60° C for 30 minutes. Streptococcus faecium (Orla-Jensen, 1919) has not been recognized as a species or variety of enterococci in this classification. However, there has been considerable evidence in recent literature to indicate that this species or variety deserves recognition. Skaudhauge,[2] in an excellent review on the classification of fecal streptococci, reported that a concentration of 1:2,500 potassium tellurite in a medium would differentiate S. faecalis from S. faecium, the latter being inhibited by this concentration. He further found that S.

faecium produced less reduction of litmus milk, always fermented arabinose and had several serological types distinct from S. faecalis. Sharpe and Shattock[3] confirmed these serological findings. Barnes,[4] considered S. faecalis and S. faecium to be two separate species as demonstrated by differences in their ability to reduce 2:3:5 triphenyl tetrazolium chloride to the red triphenyl formazan in a medium at pH 6.0. S. faecium colonies remain colorless while S. faecalis colonies take on a red color. She suggested that within the Lancefield Group D, S. faecium appears to occupy an intermediate position between S. faecalis on the one hand and S. durans and Streptococcus bovis on the other.

Other streptococci which do not meet all the criteria of the "enterococci" described above are found in great numbers in feces. This group is sensitive to 1:2,500 potassium tellurite and, as reported by Niven, et al.,[5] it does not hydrolyze arginine with the production of ammonia. S. bovis and Streptococcus equinus are two well recognized species of fecal streptococci in this group. S. bovis is a common inhabitant of cow and sheep feces. Its outstanding differential characteristics are its ability to hydrolyze starch and ferment raffinose. Serologically, many strains have been found to react with Group D sera (Shattock[6] and Perry and Briggs[7]). S. equinis, commonly found in horse feces, differs biochemically from S. bovis in that it fails to ferment lactose and most strains do not hydrolyze starch. Orla-Jensen[8] observed that many strains of streptococci found in human feces resembled S. bovis except that they did not hydrolyze starch or ferment arabinose. He named these organisms Streptococcus inulinaceus, a species which has not been recognized by Breed, et al.[1] It is evident that many varieties or biotypes of fecal streptococci can be established if identification or differentiation is based on biochemical characteristics. This situation is discussed in considerable detail by Morelis and Colobert.[9] On the basis of various physiological criteria, they found a great number of intermediate varieties or biotypes between such forms as S. faecalis and S. faecium, and they question whether it is desirable to give S. faecium separate species status at this time. The precise classification of these bacteria must await further investigation.

In the present study, over 5,000 strains of streptococci were isolated from samples of water, sewage, and feces of human beings and animals and classified by various cultural and biochemical tests. For comparative purposes, coliforms were also isolated and identified from the various samples tested. The membrane filter technic provides an excellent means of isolating the various types of enterococci or coliforms from the mixed populations found in these habitats.

Methods

For the isolation of fecal streptococci, suitable dilutions of the fecal specimens, water, or sewage samples were filtered through membrane filters and incubated on the selective M-enterococcus agar described by Slanetz and Bartley.[10] For this purpose, fresh fecal samples from human, bovine, swine, sheep, chicken, and dog sources were tested using one gram portions diluted 10^{-3}, 10^{-4}, 10^{-5}, and 10^{-6}. One ml of each dilution was filtered through the membranes. Sewage samples obtained from a local plant were diluted 10^{-2} and 10^{-3} and 10 ml portions then filtered through the membranes. For the isolation of fecal streptococci from polluted water, from one to 100 ml amounts from various brooks, rivers, ponds, wells, and a salt water bay were tested. Approximately 50 pink or red colonies were selected at random

from the membranes prepared for each sample and transferred to blood agar plates to determine hemolysis. Isolations were then made from the blood agar plates into trypticase soy broth (BBL). From the trypticase soy broth cultures, each strain was inoculated into various test media necessary to establish its identity. To determine the types of coliforms present, approximately 50 colonies were isolated from membrane filters incubated on M-Endo broth (BBL) prepared for each sample. These cultures were then identified on the basis of IMViC reactions.

To determine the viability of fecal streptococci in water, suspensions of selected test strains were made by washing the cells from 24 hr trypticase soy agar slant cultures using the same type of water in which they were to be immersed. Ten ml aliquots of each suspension containing from one-half to one million organisms per ml were placed in sterile dialyzing bags. The tops of the bags were then securely tied and the bags suspended in wire cages of about one cubic foot capacity enclosed on all sides. About 10 such bags were prepared for each strain so that individual bags could be tested at each sampling period. The cages were suspended in the various types of water so that they remained submerged at all times. Plate or membrane filter counts of the organisms were made thereafter at one, two, three, four, and seven day or longer intervals. The viability of the fecal streptococci was also determined after storage of water samples at 8° and 26° C for different time intervals.

Types and Characteristics of Fecal Streptococci from Various Sources

While all strains of fecal streptococci studied were tested for growth in 6.5 per cent NaCl broth, growth at a pH of 9.6, in 0.1 per cent methylene blue milk and at temperatures of 10° and 45° C, the final differentiation was based on the reactions or tests listed in Table 1. Although there is still considerable difference of opinion regarding the nomenclature and classification of these organisms, the chief species or types encountered in this study are given in this table. The outstanding characteristic of S. faecalis and its varieties or biotypes from human feces was their inability to ferment raffinose. Approximately 700 strains studied from this source were unable to ferment this carbohydrate. It is interesting to note that typical S. faecalis was isolated from human feces, but not from animal species except in one instance from a dog. Thus, this organism appears to be chiefly of human origin. Cooper and Ramadan[11] reported similar conclusions. The types designated as S. faecalis biotype I and S. faecalis var. liquefaciens were also prevalent in feces from human beings. One interesting finding using the membrane filter technic for the detection of fecal streptococci in feces was the fact that in fresh fecal specimens, the S. faecalis and S. faecium type colonies were outnumbered many times by tellurite sensitive forms that grow as small pink colonies on the membranes. In human feces, these organisms resembled most closely S. inulinaceus (Orla-Jensen) and some of their biochemical characters are given in the table. These organisms have not been detected in significant numbers in sewage indicating their apparent loss of viability outside of the intestinal tract. Other types of fecal streptococci isolated from human feces included S. durans, yellow pigmented streptococci and, in one instance, S. bovis. It was observed that considerable variation occurred in the predominant types of fecal streptococci in feces of different individuals and even of the same individuals when examined at different times. It should also be noted, as is

Table 1—Predominant Types of Fecal Streptococci Isolated from Feces of Man and Animals

Fecal Source	K-tellurite	6.5% NaCl	E.V.A. Broth	Gelatin liq.	Arginine	Starch	L-arabinose	Glycerol	Raffinose	Sorbitol	Type of Fecal Streptococcus
Human 700 strains—	+	+	+	−	+	−	−	+	−	+	S. faecalis
16 subjects	+	+	+	+	+	−	−	+	−	+	S. faecalis var. liq.
	+	+	+	−	+	−	+	+	−	−	S. faecalis biotype I
	+	+	+	−	+	−	±	±	−	±	S. faecalis biotypes
	P*	+	+	−	+	−	+	±	−	±	S. faecium
	−	±	±	−	−	−	−	−	±	−	S. inulinaceus
Bovine 500 strains—	−	±	±	−	−	+	±	±	+	−	S. bovis
15 cows	+	+	+	−	+	−	±	−	+	−	Raffinose fermenters
Swine 136 strains—	P	+	+	−	+	−	+	−	−	−	S. faecium
6 hogs	+	+	+	−	+	−	−	±	−	−	S. faecalis biotypes
	−	±	±	−	−	±	−	−	+	−	S. equinus
Chicken 128 strains—	+	+	+	+	+	−	−	+	−	+	S. faecalis var. liq.
6 birds	+	+	+	−	+	−	+	±	−	±	S. faecalis biotypes
	P	+	+	−	+	−	+	−	−	−	S. faecium
	−	±	±	−	−	−	−	−	±	−	S. inulinaceus
	+	+	+	−	+	−	+	−	+	−	Raffinose fermenters

* P = partial inhibition.

indicated in Table 1, that many biotypes of S. faecalis were obtained based on fermentation reactions in L-arabinose, glycerol, and sorbitol.

The types of fecal streptococci isolated from bovine, swine, and avian species are also indicated in Table 1. As others have reported, S. bovis was found in large numbers in fresh bovine feces, frequently being the only type of streptococcus isolated. Some of the characteristics of this organism are listed in Table 1. A tellurite resistant streptococcus which fermented raffinose but not starch was also frequently isolated from bovine feces. This type resembles S. faecalis biotypes except for its raffinose fermenting property.

From the swine feces tested, only S. faecium, S. equinus, and certain S. faecalis biotypes were identified. In chicken feces, S. faecalis var. liquefaciens was found to predominate but S. faecium, S. inulinaceus, and S. faecalis biotypes were also present regularly. Raffinose fermenting types similar to those found in bovine feces were also identified.

While not shown in Table 1, the types of fecal streptococci found in sheep, horse, dog, and insect feces were also determined. The fecal streptococci isolated from sheep feces were similar to those found in bovine feces, except that S. faecalis var. liquefaciens was also present in most of the samples tested. The predominant species of streptococci found in horse feces was S.

equinus. However, other types of fecal streptococci were also present except S. faecalis and S. bovis. The samples of dog feces tested showed the greatest variety of fecal streptococci of any of the domesticated animals tested. However, no S. faecium strains were identified and S. faecalis was isolated from only one fecal specimen. Organisms resembling S. faecium and S. faecalis biotypes have been isolated from the gut and feces of various insects. While streptococci from insect sources are probably of little importance in water analysis, it may indicate the origin of such organisms on certain plant materials or in certain foods as reported by Mundt.[12]

The types of fecal streptococci that could be detected in sewage and in polluted water are listed in Table 2. All of the species or types of fecal streptococci found in feces of human beings and animals were also isolated from sewage and water using the membrane filter M-enterococcus agar technic. The percentage distribution of the species or types identified on the basis of the number of strains studied is indicated in the table. While the tellurite sensitive S. inulinaceus type of streptococci are found in great abundance in fresh fecal specimens, they were far outnumbered by S. faecalis and other tellurite resistant strains in sewage and sewage polluted water. As previously indicated, the former organisms apparently soon die when exposed to the environment outside of the intestinal tract. It also appeared that more variations in characteristics occurred in strains of fecal streptococci isolated from sewage and water than occurred in strains isolated directly from feces. This may be due to the effect of environmental factors on the organisms after leaving the human or animal body and increases the problem of identifying or classifying these organisms from such sources.

As previously noted, the types of coliforms present in the same samples of feces, sewage, and water used for our fecal streptococci studies were also determined. The types detected by MF technics and identified by the IMViC reactions are given in Table. 3. As can be seen, from 92 to 100 per cent of the strains of coliforms isolated from human and various animal feces were Escherichia coli types. In sewage and contaminated water, the E. coli types dropped to about 50 per cent of the

Table 2—Types of Fecal Streptococci Isolated from Sewage and Polluted Salt and Fresh Water

Source	No. of strains	Per cent of Strains Identified as: S. faecalis	S. faecalis var. liq.	S. faecalis biotypes	S. faecium	K-tell. sen. types*
Sewage	653	15	9	51	10	15
Sea Water (Bay)	1,034	14	5	59	5	17
River Waters (5)	456	9	8	36	16	31
Pond Waters (2)	171	22	5	57	4	12
Well Waters (5)	168	2	14	42	12	30

* This includes S. durans, S. inulinaceus, S. bovis, and S. equinus.

Table 3—Types of Coliforms Found in Human and Animal Feces, Sewage, and Polluted Salt and Fresh Water

Source	No. of strains	Per cent of Strains Identified as: E. coli Type I	E. coli Type II	Intermediate Type I	Intermediate Type II	A. aerogenes Type I	A. aerogenes Type II	Other Types
Human feces	558	92	8	—	1 strain	—	—	—
Bovine feces	375	96	3	—	—	—	—	1
Swine feces	91	98	2	—	—	—	—	—
Chicken feces	116	96	—	1	—	—	2	1
Sheep feces	166	100	—	—	—	—	—	—
Horse feces	41	92	8	—	—	—	—	—
Dog feces	237	92	—	3	5	—	—	—
Sewage	538	48	2	1	18	7	5	19
River waters (5)	181	44	7	6	17	8	1	27
Pond waters (2)	114	65	5	5	6	4	4	11
Well waters (5)	131	37	5	29	4	2	4	19
Sea water (Bay)	627	32	3	10	7	12	8	28

total coliforms isolated. This points up the fact that many coliforms probably enter sewage and water from other than fecal sources, as suggested by other workers.

Viability of Fecal Streptococci in Water

Known numbers of bacteria from recently isolated strains of S. faecalis, S. faecalis var. liquefaciens, S. faecalis biotype I, S. faecium, and S. bovis were suspended in dialyzing bags and immersed in fresh water in a river and salt water in a bay at temperatures of approximately 20° C. The numbers of bacteria remaining after different intervals of time were then determined by plating both in trypticase soy agar and by use of membrane filters incubated on the M-enterococcus agar.[10]

These studies revealed a decrease in the numbers of viable cells ranging from 25 to 75 per cent of the population during the first 24-hour period. This was followed by a less pronounced die-off for three to four days with only small numbers or none remaining viable after seven days. S. faecalis biotype I and S. faecium appeared to be the most viable of the strains of fecal streptococci tested. It is interesting to note that there was little difference in the numbers of fecal streptococci at different immersion periods as estimated by the plate counts using a trypticase soy agar and the membrane filter counts using M-enterococcus agar, a selective medium. This again indicates the efficiency of the latter technic for recovering or enumerating fecal streptococci in water.

The effect of storage of water samples on the viability of fecal streptococci at 8° C and at room temperature (26° C) was also studied. Comparative tests for coliforms were made at the same time. Each sample was tested one hour after collection and then after storage for one, two, and four days at the above temperatures. The num-

bers of fecal streptococci and coliforms were determined by the MF technics previously described.

Examples of some of the results obtained are given in Table 4. Little change in the numbers of fecal streptococci and coliforms, except a slight increase in numbers, occurred when the samples were stored at 8° C for periods up to two days. There was a definite decrease in numbers of these organisms in samples stored at 26° C after the one-day storage period.

Comment

As previously pointed out, the nomenclature and classification of fecal streptococci still presents many problems. This is chiefly due to the fact that many variations occur in the biochemical characteristics of different strains and it is difficult to determine what types should be given species, variety or biotype status. The continued use of the term "enterococcus" to designate a certain group or certain types of fecal streptococci also presents some problems. Rather than limit the use of this term for the streptococci that meet the so-called Sherman criteria, it would appear desirable to have it include all streptococci commonly inhabiting the intestinal tract of man and animals.

While the nomenclature and classification of fecal streptococci needs further study, this in no way should interfere with the use of these organisms as indicators of water pollution. We do have highly efficient tests to detect and enumerate these streptococci in water samples. Direct colony counts can be made when the membrane filter technic is used. We have found that organisms producing large maroon colored colonies on the membranes are usually the tellurite resistant S. faecalis types of fecal streptococci and that the small pink colonies are usually tellurite sensitive S. bovis type streptococci. If confirmation for fecal streptococci is desired, the colonies developing on the membranes can be checked by Gram stains and appropriate cultural tests.

Our studies on the types of streptococci present in feces of human beings and animals indicate that it might be possible, in certain instances, to distinguish between human and animal fecal contamination. While typical S. faecalis may not always be the predominant type of streptococcus in human feces, it is not found in the feces of most domestic animals. Thus, its presence in water would indicate contamination of human origin. Also, the raffinose fermenting, tellurite resistant fecal streptococci appear to be of animal origin, particularly cows and sheep. The presence of S. bovis in a

Table 4—Effect of Storage of Water Samples at Different Temperatures on the Viability of Fecal Streptococci and Coliforms

Storage Period	Fecal Streptococci Polluted River Water				Coliforms Polluted River Water			
	A		B		A		B	
	8C	26C	8C	26C	8C	26C	8C	26C
1 hr.	98*	98	400	400	58	58	785	785
24 hr.	91	66	449	441	80	49	1,025	530
48 hr.	87	30	447	205	88	55	1,250	40
4 days	82	82	143	22	73	27	670	90

* Numbers of bacteria per 100 ml of water.

water sample would indicate recent bovine or ovine pollution. These organisms can be identified or differentiated by culture in gelatin, arabinose, raffinose, starch, sorbitol, and potassium tellurite media.

On the basis of our studies, we feel that membrane filter tests for fecal streptococci are more practical, efficient, and accurate than coliform tests for evaluating the sanitary quality of almost all types of water and these tests deserve serious consideration by everyone interested in improving our bacteriological procedures for water analysis.

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The distribution of fecal streptococci and their application to the interpretation of pollution problems is a matter of considerable current interest. The study reported here investigated the streptococci present in the feces of human beings and of a few domestic animals.

FECAL STREPTOCOCCI. II. QUANTIFICATION OF STREPTOCOCCI IN FECES

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THE STREPTOCOCCAL densities of 23 surface water and two sewage samples were measured by Kenner, Clark, and Kabler using four different streptococcal media. Two of the media were used with the multiple tube test, one medium for a membrane filter method, and the fourth, experimental KF Streptococcus Medium, by both procedures. There were significant differences between the three MPN procedures and between the two membrane filter methods, with the KF Streptococcus Medium yielding higher densities by both MPN tests and membrane filter counts. A detailed study was made of 698 colonies growing on the membranes which had KF Streptococcus Medium as a nutrient solution. They were able to confirm streptococci in all 698 colonies and failed to observe any nonstreptococcal bacteria in this series of samples. These data suggested that the differences on KF Medium by both MPN test and MF technic could be due to the number of species of streptococci which were able to grow on the more productive medium.

This study investigated the streptococci present in the feces of human beings and a few domestic animals, such as the cow, pig, sheep, and fowl, and classified them into broad groups by a minimum number of selected biochemical reactions. The study should yield information which would have value in the interpretation of the significance of the streptococci as indicators of the various types of animal pollution. The investigation of the groups of streptococci in feces may indicate whether there are other streptococci, in addition to the enterococcus group, which have some importance as indicators of fecal contamination in polluted waters or in tracing sources of pollution.

The enterococcus group[1] is defined for the purpose of this study as streptococci which grow at 45° C and 10° C, grow in 6.5 per cent sodium chloride in broth or at pH 9.6, and are tolerant to 0.1 per cent methylene blue in milk, consisting of the species Streptococcus fecalis and its varieties of liquefaciens and zymogenes and Streptococcus durans. Fecal streptococci in this study are defined as the group composed of species consistently present in significant numbers in fresh fecal excreta, which includes all of the enterococcus group

in addition to other groups of streptococci.

Methods

One gram of fresh feces was added to 99 ml of sterile phosphate buffered distilled water containing glass beads. This was shaken until a uniform suspension of the fecal material was produced. Appropriate quantities of the suspension were filtered through membrane filters and cultivated on KF Streptococcus Medium[2] for a colony count of the streptococci and the identification of a representative number of colonies from each animal feces tested. The streptococcal densities were reported as colony counts per gm (wet weight) of feces for each group of animals.

Between 20 and 50 colonies from each fecal sample were cultivated in pure culture in brain heart infusion broth tubes by incubation at 35° C for 24 hours. A gram stain was made and the following media inoculated for each strain:

1. Growth in brain heart infusion broth at 45° C in two days;
2. Reactions in litmus milk as observed at intervals of one, two, three, four, and seven days;
3. Reaction in sterile milk containing 0.1 per cent methylene blue at intervals of one, two, three, and seven days;
4. Growth in 6.5 per cent sodium chloride in brain heart infusion broth after three days;
5. Reduction of potassium tellurite (1:2500) in sterile milk within seven days;
6. Growth in brain heart infusion broth adjusted to pH 9.6 in three days;
7. Growth in 40 per cent bile contained in brain heart infusion broth in three days; and for some strains;
8. Fermentation of 1 per cent sorbitol in cystine trypticase agar.

The incubation temperature was 35° C for the above reactions unless otherwise noted. Composition and preparation of the media is described in the Appendix of this report.

Results

Streptococcal counts by the membrane filter procedure were calculated in millions per gm (wet weight) of feces. The median density for human feces was 3 million, for cows 1.3 million, for sheep 38 million, for pigs 84 million, and for fowl 3.4 million per gm. These values represent fecal samples from 18 adult human beings, six cows, five sheep, five pigs, and ten fowl.

Colonies were selected at random from the membranes for each of the fecal samples. A total of 1,092 colonies were composed of gram positive cocci in chains of two or more organisms with occasional pleomorphic cocci. None of the colonies picked from the membranes in this study belonged to non-streptococcal species. All of these strains were cultivated in pure culture in brain heart infusion broth for subsequent biochemical tests. Reactions by eight biochemical tests were used to classify the streptococci in groups or species according to reactions described in "Bergey's Manual of Determinative Bacteriology"[1] or those described in Sherman's review.[3] The results are summarized in Table 1.

There were 562 strains included in the enterococcus group, 77 strains in the S. mitis-salivarius group, 186 cultures in the S. bovis group, and 58 representatives of the S. equinus group (S. equinus and S. acidominimus) to account for 884 strains of streptococci. The remaining 208 strains representing 19.1 per cent had one or more biochemical reactions which disagreed with the typical characteristics of the above groups. These were classified as enterococcus group biotypes.

In addition to the reactions described above, the ability of each strain to grow in ethyl violet azide (EVA) broth was determined. There were 548 strains representing 97.5 per cent of the enterococcus group and 62 cultures or 80.5

per cent of the S. salivarius group showing growth in EVA broth. The S. bovis and S. equinus groups contained many strains inhibited by EVA, with approximately 20 per cent of each group producing growth. The biotype group gave growth with 119 cultures or 57 per cent. The above strains are summarized in Table 2 according to number and percentage in each group and the source of fecal samples.

Reference to Table 2 indicates that human feces contain enterococcus and S. salivarius groups with the addition of a few strains (6.8 per cent) of enterococcus biotypes. Feces from quadrupeds contain large numbers of the S. bovis and S. equinus groups, relatively few enterococci (10-31 per cent), and none of the S. salivarius group. There are increasing numbers of biotype strains in the feces of the cow, sheep, and pig. Streptococci in the feces of fowl have a different distribution of species with approximately three-fifths members of the enterococcus group and the remainder being enterococcus biotypes. There is an absence of the other characteristic groups found in the human beings and the quadrupeds. EVA broth showed positive reactions with 94 per cent of human, 85 per cent of fowl, 41 per cent each of cow and pig, and 26 per cent of sheep strains of streptococci.

Table 1—Biochemical Reactions of 1,092 Cultures Isolated from Fresh Feces

Biochemical Reaction	Enterococcus Group	S. mitis-salivarius Group	S. bovis Group	S. equinus-acidominimus Group	Enterococcus Biotype Group
Growth at 45° C	+	(±)	+	+	+
Growth in 6.5 per cent sodium chloride	+	−	−	−	∓
Growth at pH 9.6	+	−	−	−	±
Growth in 40 per cent bile	+	−	+	±	+
Litmus Milk:					
Acid	+	+	+	−	+
Coagulation	+	+	+		+
Reduction	(+)	Partial	+		+
Peptonization	±				±
Reduction 0.1 per cent methylene blue in milk	+	−	−	−	∓
Reduction of potassium tellurite (1:2500)	+	+	− (tr. in 7 days)	(∓)	±
Fermentation sorbitol	±	−	Not used	Not used	±
Final pH in glucose broth	3.9-4.6	4.0-5.8	4.0-4.5	Not used	4.0-5.8
Growth in ethyl violet azide broth:					
Number of strains	548	62	37	11	119
Percentage	97.51	80.51	19.89	19.00	57.21
Total number of strains isolated	562	77	186	58	208

Table 2—Occurrence of Streptococcal Groups in Feces of Man, Cow, Sheep, Pig, and Fowl

		Source of the Fecal Samples				
		Human	Cow	Sheep	Pig	Fowl
Enterococcus group	Number	360	21	31	10	139
	Percentage	76.3	12.3	24.8	10.0	61.8
S. salivarius group	Number	77	None	None	None	None
	Percentage	16.3				
S. bovis group	Number	None	104	50	32	1
	Percentage		61.2	40.0	32.0	0.4
S. equinus group	Number	3	24	8	24	None
	Percentage	0.6	14.1	6.4	24.0	
Enterococcus biotypes group	Number	32	21	36	34	85
	Percentage	6.8	12.4	28.8	34.0	37.8
Growth in EVA broth at 35° C	Number	444	69	32	41	191
	Percentage	94.1	40.6	25.6	41.0	84.9
Total streptococcal cultures	Number	472	170	125	100	225

Discussion of Results

The median streptococcal density per gm of feces yields no information on the total number of streptococci discharged per day from the gut of the typical animal of the group. There is considerable variation in densities between animals of the same species, and these data come from a relatively short series. Even with these limitations, the following calculations should have considerable value in estimating the quantity of pollution from groups of animals located on a watershed or from a surface drainage area. These estimates are summarized in Table 3.

Based on the average percentage of the enterococcus group (from Table 2) the respective number of the enterococcus density for various animals per day would be approximately 372 million for the human being, 384 million for the chicken, 3,670 million for the cow, 10,735 million for sheep, and 22,680 million for the pig. In the routine examination of a surface water, the enterococcus group density alone would give no indication as to the source of the pollution, such as human, quadruped, or fowl.

Eight or, in some instances, nine biochemical tests were used in the study of the 1,092 strains isolated from feces of animals, human beings, and fowl. Considering the fecal source of the samples, the group classification by the biochemical reactions as presented in Table 1 appears to be a reasonable and proper procedure. In addition to these biochemical reactions, tests for growth at 10° C; hydrolysis of starch; tolerance to 0.01 per cent methylene blue, 2 per cent and 4 per cent sodium chloride; and thermal resistance at 60° C for 30 minutes should be included where a careful and detailed classification of the streptococci is required. The streptococci in domestic wastes from human origin should yield between 70 per cent and 80 per cent of the strains showing growth in both 6.5 per cent sodium chloride and in medium at pH 9.6. A markedly lower percentage in positive tests by the salt tolerance and pH 9.6 growth would

be suggestive of quadrupeds. Such a procedure would give no significant differences in streptococci from human and those of fowl origin.

Pollution of human origin would be indicated by the presence of a high percentage of the enterococcus group, qualitative demonstration of the S. salivarius group, and very few strains of enterococcus biotypes. Finding the S. bovis group or S. equinus group indicates pollution of animal sources and with a reasonable certainty that, as the percentage of these two groups increases, the quantity of animal fecal pollution is increasing. Fowl fecal pollution would be indicated by a large percentage of the group classified as biotypes and the enterococcus group. In mixtures of all five types of fecal pollution the problem is more complicated, but it is possible to make qualitative interpretation as to the possible source of the pollution. The absence of the S. salivarius group does not exclude the presence of human fecal pollution, since it is a relatively sensitive organism with a rapid death rate in polluted surface waters.

The classification of the enterococcus group biotypes requires additional investigation. They cannot properly be considered to belong to the enterococcus group since they vary in one or more of the commonly accepted critical characteristics used in the classification of the enterococcus. However, due to their close resemblance in reactions to the enterococcus group and greater variations from the other fecal streptococcal groups, they have been tentatively described as biotypes. This heterogenous group of biotypes tends to show some characteristic variations according to the host species from which it was derived.

The relation of species of streptococci with animal species has been suggested by other investigators. Barnes, Ingram, and Ingram[4] believed S. faecium to be the dominant species on the skin of pigs. Cooper and Ramadan[5] have pointed out that S. bovis definitely is of animal origin. Fewins, Newland, and Briggs[6] found the streptococci density much higher than the coliform densities in pig feces. Results of this investigation are in agreement with all of these investigators.

Table 3—Estimated per Capita Discharge of Fecal Streptococci and Enterococci from Human, Chicken, Cow, Sheep and Pig

	Human	Chicken	Cow	Sheep	Pig
Average weight of 24-hour fecal discharge (wet weight in grams)	150*	182†	23,600‡	1,130‡	2,700‡
Streptococci per gram in millions	3.0	3.4	1.3	38.0	84.0
Total number of streptococci discharged per day in millions	450.	619.	30,680	42,900	226,800
Enterococcus group—percentage	76.3	61.8	12.3	24.8	10.0
Total enterococci discharged per day in millions	372.	384.	3,670	10,740	22,680

* Best, C. H., and Taylor, N. B. The Physiological Basis of Medical Practice, Baltimore, Md.: Williams and Wilkins, 1955, pp. 846-848.

† Dr. C. A. Denton, Poultry Nutrition Section, Agricultural Research Center, U. S. Department of Agriculture, Beltsville, Md.

‡ Dr. Russell E. Davis, Assistant Chief, Beef Cattle Research Branch, U. S. Department of Agriculture, Beltsville, Md.

Summary

The median density of streptococci in millions per gram of moist feces was 1.3 for cow, 3.0 for human beings, 3.4 for fowl, 38.0 for sheep, and 84.0 for the pig. Enterococci densities were 0.16, 2.29, 2.10, 9.42, and 8.40 millions per gram, respectively. The average number of streptococci discharged in a 24-hour period increased in the order of human being, fowl, cow, sheep, and pig. The enterococcus and S. salivarius groups predominated in human feces to account for 92.6 per cent of the streptococcal population; enterococcus and streptococcal biotypes represented all the streptococci in feces of fowl; and quadrupeds showed appreciable quantities of the S. bovis and S. equinus groups, which were approximately 75 per cent for cow, 46 per cent for sheep, and 56 per cent for the pig. The enterococcus group on a percentage basis is low in animal feces, but it cannot be used as a differential procedure from human pollution since, on a daily basis, more enterococci are discharged per animal than by the average person. Human being and fowl strains grow well in ethyl violet azide broth, with 94 per cent and 85 per cent showing positive reactions. Growth was reduced to between 41 per cent and 26 per cent for strains from quadrupeds.

A careful classification of the streptococcal groups permits a qualitative interpretation of the possible sources of pollution. The enterococcus group used as an indicator of pollution yields from 77 per cent of the total streptococci from human pollution to a low of 10 per cent from pig feces. The fecal streptococci, based on results of this investigation, consist of the enterococcus group, S. mitis-salivarius group, S. bovis group, S. equinus group, and an atypical group closely resembling the enterococcus group, but with one or more differences in critical biochemical tests. Sufficient data have been accumulated to justify further investigations in the distribution of the fecal streptococci for application to the interpretation of pollution problems. The description as fecal streptococci rather than enterococcus is suggested.

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APPENDIX

Streptococcal Media

1. The 45° C Growth Test—Incubate streptococci in brain heart infusion broth at 45° for two days and examine for growth.
2. Litmus Milk Reaction—Sterilize the litmus milk at 115.2° C (10 lb for 10 minutes). Read reactions of streptococci at one, two, three, four, and seven days.
3. Methylene Blue Test—Add sufficient 1 per cent sterile solution of methylene blue to sterile skim milk to have a final concentration of 0.1 per cent methylene blue. Observe reactions at one, two, three, and seven days.
4. Sodium Chloride (6.5 Per cent) Tests—Inoculate brain heart infusion broth containing 6.5 per cent sodium chloride and observe for growth of streptococci within three days.
5. Potassium Tellurite Reduction—Add sufficient sterile potassium tellurite solution to sterile skim milk to have a final concentration of 1:2500 potassium tellurite. Observe for reduction at three and seven days.
6. Growth at pH 9.6—Add sterile 38 per cent sodium phosphate solution ($Na_3PO_4 \cdot 12H_2O$) to sterile brain heart infusion broth to give a pH 9.6 reaction. This

usually requires approximately 5 ml of phosphate solution per 100 ml of medium. Observe for growth of streptococci within three days.

7. Tolerance Test in 40 Per cent Bile—Add 40 ml of sterile 10 per cent Oxgall solution to 60 ml of sterile brain heart infusion broth. The 10 per cent Oxgall solution is equivalent in concentration to fresh bile originally used in this test. Positive cultures show growth within three days.
8. Sorbitol Fermentation—Sorbitol, 1 per cent, added to phenol red agar base medium or cystine trypticase agar. Incubate three days for fermentation tests.

The above media were prepared by reconstitution of dehydrated media and sterilized according to the recommendation of the manufacturer, except where other time and temperature are indicated in the media descriptions. All tests were incubated at 35° C except where other incubation temperature is specified for the test.

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This paper was presented before the Laboratory Section of the American Public Health Association at the Eighty-Seventh Annual Meeting in Atlantic City, N. J., October 20, 1959.

From America's Oldest Federated Charity

"It is ironic that today's golden age of medicine has combined with a general rise in the cost of things to drive the voluntary hospitals of New York and the country generally into a state of grave distress. . . . In effect, the problem now confronting the public is one of hospital impoverishment in the midst of medical plenty. The key question is whether, as a matter of public policy, the voluntary hospital as an institution shall be allowed to proceed to serve the sick as in the past or whether, through inadequate financing, it shall disappear and its function be taken over by government." (From "A Tradition of Service," United Hospital Fund of New York, 1960.)

Experiences with community self-studies of health problems in Kansas communities are presented. The authors emphasize the educational potential and value in such activities. Furthermore, they indicate the great value of having citizens work with professionals. The development of such tools as a study guide and a household survey schedule are discussed.

COMMUNITY HEALTH STUDIES IN KANSAS

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"Public sentiment is everything. With public sentiment nothing can fail; without it nothing can succeed." A. Lincoln

THAT PUBLIC HEALTH DEPARTMENTS have duties of broad scope and that these duties are not strictly limited to a short list of prescribed duties is apparent from even casual reading of the general language of statutes and ordinances pertaining to the subject. This general obligation is perhaps best expressed in the charge to "take cognizance" of all matters affecting the public health.

Cognizance, then, is the first step and action the second. One action is leadership in assisting a community to define its own problems, to make an inventory of its health resources, to plan its program and to take the desired action.

Succinctly stated our belief in the "self-survey" process arose from convictions that people must do for themselves, for intrinsic motivation is most likely to lead to effective action. It has been suggested that "education of the public is not to be achieved through ex cathedra pronouncements"[1] and our experience that new health services did not arise out of such pronouncements was confirmation. Public health needs a "built-in readiness to evolve," to avoid "ossification,"[2] insensitivity to the desires of the people,[3] and to avoid eventual disappearance.[2]

The "concept of taking the people into active participation in community health work is a century old."[4] Examples of the reasons for doing so are abundantly found in public health literature.[5-17] The statement which we accepted as perhaps most succinctly and accurately expressing our intent was "Not 'to tell something to the people,' nor is it 'to work out a solution with the people' . . .; (but) to help people work out their own solution to their own health problems,"[18] thus fulfilling a major assignment "to increase the competence of individuals, families, and communities to cope with their own health problems"[19] and hence to multiply our own effectiveness through dele-

gation. The participation of an unusually large number of people in each community in the survey process helps to realize this ideal and hopefully to avoid having the self-survey become simply a mechanism whereby a few persons in a leadership position sell their preconceived ideas to the community and as a result equate or translate self-interest to community interest.[20]

Finally a principal need was for the health department "to assume its full position of leadership in community surveys and studies of health needs and resources, and in community planning and provision."[21] That our leadership was covert rather than overt or egregious and was fully shared with others is indicated both in the foregoing expression of working philosophy and in the experiences recounted below.

Community interest was aroused in a few localities and spread contagiously to others. Three communities have completed their self-studies and developed and received the report; two others are in process and several additional ones in prospect. Our experience with community health studies is doubtless not unique. Relating it may strike a sympathetic note with some and be stimulatory to others.

The Impetus

Each community is concerned about some of its health needs. In each community where a study has been completed or is being conducted there is a most heartening amount of local interest in health problems. This interest has been a headless thing —unorganized and unformed for the most part, and only when leadership from the State Health Department was offered did the interest take on form and meaning. In the beginning requests from communities for assistance were not clear-cut and precise as to what this assistance should be. Community people simply recognized one or more problems; sometimes they were unable to state clearly what the problem was but they desired help. The recognized problems have varied from the need for a physician, uneasiness over obvious and multiple health problems, and recognition of scrambled and ineffective arrangements for public health services. One community group embarked on a study in an attempt to force public health services from its own local officials.

The State Health Department's interest centers on the reasons stated above and other factors. We have considerable faith in beneficial action following self-education. We want to gather health figures and facts not obtainable by other available means as the basis for program planning. We are and have been repelled and frustrated at the thought of continuously trying to stimulate community action, simply by relating or publicizing the things in which we believe, the needs we recognize, or by "telling" community people what they should do. These factors led us to envision the opportunities inherent in community self-studies done with ample professional public health consultation.

Organization

State Organization

We have found it advantageous to staff the self-study with a community oriented health educator. Other staff members assist but a single health educator is in charge of each community self-study to provide a central point of orientation and direction. Although we have been unable to allocate enough staff to do so, it is our judgment that each study would proceed most smoothly and successfully if the health educator could be permanently employed by the community or could be assigned full-time during a major part of the study

procedure. We have avoided overwhelming the community (especially the smaller ones) by early and frequent appearance of authoritarian figures, believing that this might damage the citizen's proprietary feeling about the study and might require the authoritarian individual to supply answers. It is our observation that the health educator appears nonauthoritarian and nonthreatening. The health educator maintains the field generalship of the study and skillfully weaves staff competencies into committee deliberations.

Local Organization

Effective community organization for a self-study requires great care and skill. The health educator's first task is to delineate the community's power structure so that every important community group and person may be included in the self-education process in order that real involvement and identification with the study occurs. These same individuals and groups must not, because of inattention on our part, be disposed to stand scornfully aside and deride the findings or obstruct the recommendations and plans resulting from the study.

The delineation of the power structure usually requires many days of directive but aimless-appearing visiting in the community, but on one occasion was done in one morning with the help of an interested and perspicacious local citizen. Coincident with learning the power structure, the community's usual pattern of action is carefully explored and understood so that if deviation is made from this pattern, it is done with knowledge, foresight and purpose.

In each community some few individuals or groups have early involved and interested themselves in the study procedure; they assist in the selection of a steering committee of suitable size, with representatives from the groups which are expected to participate in the study. Great care is taken to include the local medical organization, local elected officials, voluntary health associations, and women's organizations having special interest in health or government. This steering committee is the apparent leading and coordinating body, although the health educator is a constant observer and quiet power behind the committee. Once the steering committee has been established it invites additional individuals and group representatves to attend a public community meeting. Special attention is given to the inclusion of prestige figures at this organizational meeting, as well as to the working representatives; these prestige figures may include local citizens, state senators and representatives, and the state health officer. The program at the community meeting includes stimulating description of some recognized local problems and needs given by local people, and a description of the study process by the consultant staff. The need and reasons for the proposed health study are discussed and the two tools to be used—the evaluation guide and the household interview questionnaire, are explained. General procedure for the development of the study are outlined with some emphasis on committee structure. The usual committees are public health, school health, mental health, acute care, chronic disease, and aging. In addition, a household interview committee is formed. Toward the close of the first mass meeting the individuals attending are offered an opportunity to serve on any one of these committees. In so far as possible, individuals make their own selection of committees.

Approximately two weeks after the first community meeting a second one is held and committee assignments are completed. After a brief general meeting, members of the group assemble with their respective committees to begin their tasks. Each committee is

assigned a consultant from the State Health Department staff and this consultant, and the health educator, meet regularly with the committee.

Evolution of Study Guide and Household Questionnaire

When embarking on the first community study, the staff felt that none of the existing guides were completely suitable for use in Kansas and, therefore, undertook development of new material, drawing heavily on reference material from the American Public Health Association,[22] Joint Commission on Mental Illness and Health,[23] and Commission on Chronic Illness.[24] The basic guide[25] was first prepared as a revision of APHA material and principal revisions consisted of deleting material which subjected or exposed community people to a set of standards at which they should aim before they ever undertook the study. It seemed to us that the inclusion of this material violated the permissive attitude which we wished to maintain. More extensive morbidity data were included, especially in the field of chronic diseases and disabilities. The sections on mental health, chronic disease, school health, and community resources were, in particular, expanded. A suggested evaluation guide to be filled out on each school in the community was added, as well as a questionnaire form for each adult nursing home and nursing home resident. The latter two forms were taken from the "Model Community Survey of Local Chronic Illness Facilities and Services" of the Commission on Chronic Illness. After completion of the study guide the task of preparing a basic household interview questionnaire,[26] supplementary to the evaluation guide, was undertaken. In its preparation several factors had to be considered and it was designed with the following requirements in mind:

1. It had to be an instrument which was statistically sound so that data could be reliable within known limitations.
2. It had to be a questionnaire which could be used accurately by relatively untrained lay interviewers.
3. It had to be designed to extract information called for in the community study guide.
4. It had to be a questionnaire designed for easy coding and machine punching and tabulation.
5. It was necessary to design a basic questionnaire which could be used as a starting point in all communities in the state and which was sufficiently flexible so it could be altered to meet specific local needs.

Each of the four counties where interviewing has been completed has been given a basic "Health Study Guide and Household Questionnaire" developed by the State Department of Health and altered as described below. Each county was urged to make additions and deletions as it saw fit. While each county has made minor changes to fit the local situation, the basic questionnaire is becoming standardized. For example, the first community in which the questionnaire was used was one that was particularly concerned over the lack of medical facilities, physicians, dentists, and hospital services. Questions to gather data concerning these problems were added by the community and subsequent communities have been reluctant to drop any of these questions, though the lack of such services has not been a noteworthy specific problem in later communities. The final decisions on the questions which should be included are made by the community steering committee. Thus ideas for improving and strengthening both the community study guide and the household questionnaire are gained from each community which uses them, and these ideas are incorporated in the documents. As presented in each community, these forms are still labeled as tentative or preliminary and are in mimeograph form. We believe it is important to present these informally rather than as more formid-

able and apparently fixed printed documents on glossy pages. The local communities then feel at liberty to tinker with the informally presented material; this results in a very strong feeling of pride, identification, and possessiveness of the documents as finally prepared for use in a specific community. The materials finally used in each community have a title sheet, presenting the name of the local county and identifying towns and townships to further strengthen the localness of the survey.[27]

The Household Survey

The household survey is done by volunteers, organized into subcommittees of the household interview committee. The volunteers are furnished with a manual[28] and a brief course of instruction. It is recognized that while the household interview can be helpful in obtaining heretofore unavailable data, its true statistical value in gathering morbidity data is a controversial matter,[29,30] particularly in the field of chronic disease and disability. The net result would appear to be an underreporting of chronic illnesses, rather than overreporting. Our own experience with data gathered by the household interview indicates good correlation in those instances where analysis and comparison are possible.[31,32] Even without complete accuracy, the data does give some sort of guide line as to the extent of problems.

Two methods have been used in conduct of the household survey in the studied communities; the first is saturation interviewing—where an attempt is made to visit the largest possible number of dwellings; the second is random sampling. The latter method is more satisfactory statistically while saturation interviewing has provided the greatest possible participation of citizens and has resulted in widespread community interest in the survey process and findings. This method is most applicable to the least populous counties. In one county, 80 per cent of the families were interviewed.

Random sampling has been used in two counties and is being reported in a separate paper.[33] In random sampling, we attempted to draw a 10 per cent sample of the population with some success. This method is necessary in a larger county—simply to reduce the amount of work in interviewing as well as the number of questionnaires which must be processed. Interviewers become enthusiastic and interested in their tasks to the extent that some restraint is needed, lest the sample be expanded involuntarily.

Care is taken to see that community-wide publicity regarding the survey procedure is widespread—both before and during the survey; this doubtless assists in community acceptance and in keeping the number of households refusing admission to the volunteer interviewer at a minimum. At the same time the household survey is proceeding, the other committees meet repeatedly and complete portions of the study form not dependent on the answers from the household survey. As soon as survey information is available it is fed back to the committees.

Tabulating the Survey Data

After completion of the household interviewing, each form is checked for completeness—a few are discarded because of obvious incompleteness; the rest are sent to the IBM room for card punching and tabulating. Unfortunately, at this point, a time-lapse occurs between the end of interviewing and the reporting of the survey data. Everything possible is done to reduce this lapse, for a long delay permits some cooling of ardor and loss of interest. Statistical data when complete is compiled in table form for use of the study

committe s.[34-36] Even incomplete information is pounced on hungrily by the community committees.

Report and Planning

Reporting is done, as rapidly as possible, to the study committees, subcommittees, and to the entire community. Much of the reporting to the working committees is done informally during the fact-finding and tabulating process by the health educator and other state consultants and, at the same time, the groups are given information about successful practices. It is in this way that some standards which were deleted from the community evaluation guide are reintroduced. The resulting recommendations are those of community people since they are free to accept, reject, or modify—professional advice judgment, and standards. The recommendations are drawn up by the local subcommittees and assembled by the health educator and the steering committee.

Study findings and recommendations are widely distributed throughout the county. In the first smaller rural counties in which a study was completed, sufficient copies of the report were printed[37] so that every family could have one. Community meetings were held in which findings were discussed and copies of the report distributed. Copies were also placed in scattered locations throughout the county such as the newspaper offices, drug stores and grocery stores.

In larger urban counties, mass distribution of the printed report[38] is not economically feasible. As a less desirable alternative, emphasis is placed on seeing that every organization receives copies as well as a number of key individuals, including local governmental officials. The local newspaper is also utilized to report study findings and committee recommendations, and copies of the report are placed in the public and school libraries.

Action by the Community

The permissive guidance maintained by the state health department throughout the active study process is continued during the post-study period.

Permissiveness is deemed necessary and desirable because of the belief that the machinery through which a community carries on its daily affairs is a process with which it feels comfortable and one which has proven its utilitarian worth through the years. If not it would have been discarded.

Thus in none of the communities has a special committee or health council for implementation of study findings sprung into being. Impetus for carrying out recommendations has come mainly from two sources—already organized community groups and local governmental officials.

By the nature of its organization, the original study committee has deep and firm roots in both these resources and when its work is finished at the completion of the study, its influence continues to operate through all other organizations to which its members belong.

This method of implementation has lead to several pertinent observations: action upon study recommendations may be slow to develop; action may be somewhat latent in its nature and difficult to identify as resulting directly from the original study itself. This method also tends to fragment study recommendations into many parts, as for example, the local mental health association may assume the responsibility for the recommended mental health clinic; the county home demonstration units may adopt school vision and hearing tests as their project; and the Lions Club may choose to devote its time and energy to the development of the needed town sewerage system.

In summary it may be said that whereas community action may be somewhat slower to develop without a continuing special committee, the findings and recommendations of the study appear to have a long-lasting impact upon the entire community, as many different long established and highly esteemed organizations assume direct responsibility for implementing study recommendations which have a particular appeal to its membership.

The first community which undertook a health study probably best illustrates the improvements a community can make in its health situation following such an endeavor.

This county is a rural county of approximately 9,000 persons. Its people are old, about twice the national average, their income is low and the population is rapidly declining. Its economic assets to support needed public services are extremely limited. It presents not an atypical picture of rural areas across the nation. At the time of the health study, it was almost entirely devoid of medical care and public health services and facilities. The county had no health department, no school health program, no dentist, no hospital. Its only assets to care for its aging population with its manifold problems of chronic disease and disability were one entirely inadequate decrepit adult care home, one osteopathic physician and a stubborn, cantankerous but indomitable spirit.

Since the completion of the study, various improvements have taken place. A young physician and a dentist have been attracted to the county and have started practice. The former constructed a modern two-physician clinic building with adequate space for additional medical facilities. One town has built a sewerage system and another plans for construction of a town water system. An immunization program has been started and vision and hearing tests are performed annually on school children. A new, modern, much needed facility for care of the aging is under construction. A diabetes screening program was conducted and a second to include glaucoma tests is in future plans.

In a second county where the health study was conducted primarily to determine needs of the community in relation to the chronic diseases and rehabilitation, an experimental home care program was undertaken by Blue Cross-Blue Shield, the local medical society and the two community hospitals.

Since the study, this community has also established a mental health clinic which will offer its services to two adjoining counties.

A third county in which a study has been completed is a highly complex county and the solution to its health problems will be complex. A basic major need indicated by the study was for strengthening the local public health services. The present health department is essentially a rural health department attempting to serve a population which has become, in a few years, highly urbanized. Following the study, the board of county commissioners has begun serious consideration of methods for strengthening the health department and as a beginning have adopted a much more realistic salary scale. This should allow them to hire a public health trained physician, full time, as health officer.

Another vital need is for the development of community mental health facilities. The solution to this problem is presently being actively sought by various local groups.

A bond issue for a much needed sewerage system carried by a small majority following the health study. This issue had previously been defeated at the polls on various occasions. A bond issue for a county nursing home also carried following the health study, and facts uncovered have been utilized

in planning for a community hospital.

In a fourth county, where the final report has not yet been distributed, first stirrings of community action have been noted. This county is the largest in the state without an organized health department. In the past, local governmental officials have evidenced little interest in establishing one. Since the study, these officials have asked the State Health Department for assistance in studying this matter further.

The fifth county is still presently in the fact-finding phase.

Discussion

The self-study procedure has many strengths and a few weaknesses—the most important of which we have listed below. The self-study fulfills a basic principle of motivation; it begins with motivation by problems and goals which are within the communities understanding, immediate enough to appeal to its interest and with attainment easy enough to promise success. As the study proceeds, more remote and difficult goals are accepted without appearing forbidding to the community people. The self-study fulfills a basic principle of involvement of people and we believe that the more people become involved in studying and analyzing their own health problems, the more apt they are to find and act on an effective solution. It is noteworthy that interest and participation increase almost exponentially as the study progresses, and while the atmosphere may be a bit hesitant during the early stages of organization, it warms up rapidly. The pace, rather than continuing to be deliberate becomes so fast as to outdistance the professional consultants unless they are very alert and attentive. As the household interviewers gain poise and assurance from each succeeding interview, they become personally and emotionally involved and very concerned with the accuracy, outcome and the results of the study. There is an excellent opportunity for personnel of the State Agency to gain insight into the viewpoints of citizens and an otherwise unavailable avenue for exchange of ideas between state staff and local people is provided.

It has been our experience that the final written report is in great demand and is avidly read by citizens. The self-study gives the professional public health workers an opportunity to discover and develop interested local leaders who may later be active in other health programs. We recognize that the placement of people on subcommittees of their own choosing increases their interest and motivation in participating in the study but, in some instances, decreases their objectivity. The weaknesses or problems observed during the study procedure are not great if they are recognized, constantly watched, and tactfully moderated by staff members. There is a natural tendency for domination of the study by professional people living in the community. There is a tendency for certain power groups or persons to attempt to turn the study to their own purposes or inclinations. The steering committee needs to exercise care to see that the five subcommittees do not come into conflict, since the classification of the interest of each is obviously arbitrary and duplication may follow. For our own guidance, we have compiled a list of "do's" and "don'ts" which may be of use to others:

1. Do understand thoroughly the community power structure and do recognize fully how a particular community "does things."
2. Do not overlook powerful individuals and groups.
3. Do help develop and encourage local responsibility but never shirk organizational leadership function when the need appears.
4. Do provide good staff consultant service to each subcommittee. Recognize that certain people are engaging in the study process primarily for prestige and do what you can to satisfy this motivation while not offending others.

5. Do not give the community a slick paper printed form if you expect workers to wholeheartedly contribute ideas for adapting the study procedure to their own community needs and to strongly identify the study as their own community possession.

6. Do provide opportunity for revision of the proposed content of the survey.

7. Do assign a skilled health educator as chief consultant.

8. Do not overwhelm the community with highly authoritarian figures.

Summary

Experiences with community self-studies of health problems and resources in Kansas are presented. The introduction of these studies is an interesting innovation to professional public health workers and communities in Kansas. While it is not possible to completely analyze the things which happen in a community following the completion of a study, several observations can be made. The study process is a tremendous learning opportunity and experience—not only for citizens in local communities, but for state and local health department personnel as well. The process seems to fill a definite need for the sharing of leadership functions and responsibility between the people of a community, their group organizations, and their public health department workers.

It is our conviction that neither the citizens working alone with a prepared study guide, nor professionals in grand isolation, can successfully and meaningfully complete this process, but that both working together can elicit new information, can learn new things, and can plan together for effective action. We are pleased with the development of such tools as a study guide and a household interview questionnaire and believe that the evolutionary process herein described—whereby each community shares in the experiences of the last—has served and will continue to serve to strengthen both of these instruments.

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The need for a coordinated interdisciplinary approach to mental retardation is presented here. This approach is illustrated by the work of the New York State Interdepartmental Health Resources Board, particularly the findings obtained from the demonstration clinic. It is also shown how these may contribute to program planning at the state and local level.

AN INTERDEPARTMENTAL APPROACH TO MENTAL RETARDATION

USE OF DATA FROM DIAGNOSTIC CLINICS FROM PROGRAM PLANNING

Bernard Ferber, M.S., and I. Jay Brightman, M.D., M.S.P.H., F.A.P.H.A.

ADEQUATE determination of the needs of the mentally retarded and provision of the indicated services require the resources of several professional disciplines. In state and local governmental organization, these disciplines are for the most part located in different departments. It is essential that there be considerable teamwork among the agencies concerned, if a coordinated, meaningful, and productive program is to be achieved.

The New York State Interdepartmental Health Resources Board was established by an act of the State Legislature in 1956 for the purpose of providing such teamwork in the approach to health problems which are of significant concern to more than one state department or agency. The board's objectives are: (a) to provide a medium of exchange of information among departments relating to the various ways in which one department may be affected by the programs of another, or possibly serve or be served by these programs; (b) to provide for joint program planning, development, and evaluation; and (c) to carry out such demonstrations and special studies which are considered necessary.

In the field of mental retardation, the board works through a special committee consisting of appropriate representatives from: (a) the State Education Department which has responsibility for school classes for the educable and trainable retardates and also for the vocational rehabilitation program; (b) the State Department of Mental Hygiene which operates the state schools for mental retardates and, in conjunction with community mental health boards, administers the community mental health service program; (c) the State Department of Health which is concerned with the preventive aspects as well as with the general health of

retarded children; (d) the State Department of Social Welfare which has responsibility for child welfare; and (e) the State Department of Correction which must deal with the delinquent defective.

The board has been carrying out four phases of activities in mental retardation, as follows:

1. The development of special study projects concerning various aspects of the mental retardation problem, which are published by the board as special reports;
2. The sponsoring and supporting of local educational institutes on mental retardation designed to serve professional and lay groups and to stimulate local activities in this area;
3. The development and evaluation of demonstration diagnostic and parent counseling clinics;
4. The development of a comprehensive community mental retardation program, designed to present in one community a wide range of services for mental retardates, in order to determine their over-all effectiveness and to develop mechanisms for better integration and coordination.

This paper is devoted to the third phase of our work, namely, the demonstration clinics, and presents some of the findings believed to be of significant interest and potentially contributory to future program planning at the state and local level.

The Clinic Program

A special legislative act (Chapter 812 of the Laws of 1956) called upon the Interdepartmental Health Resources Board to "formulate and carry out an experimental program providing for the establishment and operation of two pilot diagnostic and parent counseling centers for mentally retarded children, one in the City of New York and one in the central part of the state. Such centers shall be located in a teaching hospital and each shall include a professional staff to perform the functions of early case finding, comprehensive differential diagnosis and parent counseling, for the purposes of study and evaluation of such work and the utilization of the knowledge obtained in the conduct of such programs in the making of appropriate determinations and recommendations for such services as may be necessary or desirable for mentally retarded children."

Under these provisions, diagnostic clinics and parent counseling centers were established at the Bronx Municipal Hospital Center associated with the Einstein Medical College in New York City and at the Strong Memorial Hospital associated with the University of Rochester College of Medicine. When funds became available through the U. S. Children's Bureau, a third clinic was established at the Children's Hospital of Buffalo, associated with the University of Buffalo College of Medicine.

Shortly after the clinics were established, arrangements were made to have the medical directors and key members of their staffs meet regularly to discuss various administrative and professional problems associated with clinic operations and also to provide for the coordination of recording systems so that comparable data might be obtained for research purposes. It has been very gratifying that three previously established and excellently organized mental retardation clinics, namely those at the Brooklyn Jewish Hospital, the Flower and Fifth Avenue Hospitals in New York, and the Shield of David Institute in the Bronx, have from the beginning joined the three demonstration units as full participants in the collection of the research data.

To meet the board's needs for program planning, a system of mental retardation clinic reporting was started January, 1959, and continued through December 31, 1959. Each of the six clinics completed a confidential MR-1 card for every individual for whom an intake interview was done, whether or

Table 1—Individuals* Seen in Selected Mental Retardation Clinics by Age at Intake Interview and Sex—New York State, 1959

Age at Intake Interview (Years)	Individuals Seen in Mental Retardation Clinics					
	Total		Males		Females	
	No.	%	No.	%	No.	%
Total	710	100.0	466	100.0	244	100.0
0-1	50	7.0	30	6.4	20	8.2
2-3	143	20.1	96	20.6	47	19.3
4-5	189	26.6	123	26.4	66	27.0
6-7	146	20.6	95	20.4	51	20.9
8-9	74	10.4	48	10.3	26	10.7
10-11	56	7.9	42	9.0	14	5.7
12-13	35	4.9	22	4.7	13	5.3
14 and over	17	2.4	10	2.1	7	2.9
Median age	5.7		5.7		5.7	

* Reported as having been evaluated, rejected for service, or who withdrew from clinic.

not such individual was accepted for work-up. This report was then submitted to the board at the completion of the clinic staff evaluation conference or at any previous time that the case was terminated.

The MR-1 card called for various identification data, school status at time of the evaluation conference, previous services in mental retardation, source of referral, clinical evaluation, recommendations for services, and prognosis.

This report is based upon information for 710 patients for whom cards were received.

1. Age and Sex of Individuals Seen in Clinics

Table 1 presents data regarding the age and sex distribution of individuals seen in the clinics for diagnostic evaluations. It seemed important to determine whether referrals were being made at a sufficiently early age to permit best results in regard to parent counseling and service planning.

Most of the cases seen in the clinics were in the younger age groups, with about 54 per cent under six years of age. The Shield of David Institute had the youngest group. This is related to the fact that this facility operates a school service for children up to eight years of age and therefore its primary interests are with this age group.

The sex distribution of the individuals seen in the clinics indicates that, at nearly all age levels, about twice as many boys were referred as girls. This finding is consistent with prevalence studies of mental retardation.[1]

2. Previous Services Received

Questions were asked concerning services in mental retardation which were received prior to coming to the clinic. This item was designed to determine the extent to which shopping around was practiced, and in the light of the present clinical evaluation, the needs which had or had not been filled.

For 40 per cent of the patients, no previous specialized services in mental retardation had been received. About

39 per cent had received one service, 14 per cent two, and 7 per cent three or more. Thus, there is no over-all evidence of parents or guardians making excessive use of the existing specialized facilities.

Of the 426 individuals receiving one or more services, only about 9 per cent had received a previous diagnostic work-up in a specialized mental retardation clinic (Table 2). Actually this drops down to a negligible percentage if the Shield of David Institute is eliminated. As this facility provides a school service, it receives many referrals from other diagnostic centers.

The same applies to the approximately 15 per cent of the children having received specialized mental retardation service in pediatric clinics. Again, with the elimination of the Shield of David Institute, the percentage is significantly decreased.

Eleven per cent received private medical consultation in reference to mental retardation or an associated disability. However, these cannot be considered as comprehensive consultations from the mental retardation viewpoint.

It is noted that about 41 per cent had received psychiatric or psychological services and 18 per cent had received special schooling or other special training.

Although there was considerable variation among the clinics regarding prior services received by their patients, it is apparent that relatively few of the individuals reporting to the clinics had had an adequate work-up previously.

3. Acceptances by Clinics and Clinical Evaluation

Of the 710 children seen, 655 or about 92 per cent were accepted and completed the diagnostic work-up. Twenty-two other individuals although accepted, withdrew before completing all the required tests. Thirty-three individuals were rejected for service either because they had been fully evaluated elsewhere or because a diagnostic evaluation was not indicated. For 21 or about 64 per cent of the rejectees, contacts with other service agencies were made.

The individuals completing their evaluation were classified as: (a) retarded, (b) not retarded, or (c) "questionable." Although factors other than IQ could decide the grouping, an individual with an IQ of 75 and below was generally considered retarded. Individuals for whom no clear-cut decision could be reached were classified as "questionable." For those classified as definitely retarded, the functional level in terms of educable, trainable, and untrainable was also listed. In most instances, individuals classified as educable were in the IQ range 50-75, individuals classified as trainable were in the IQ range 25-49, and individuals classified as untrainable were below 25.

Table 3 points out that the diagnosis of mental retardation was made in 482 or about 74 per cent of the 655 evaluatees, and 84 or 13 per cent were classified as "questionable." The fact that 89 or approximately 14 per cent of the evaluatees were considered to be not mentally retarded is of particular significance. It would seem that the diagnostic centers can serve a wider purpose if they accept suspected as well as obvious cases. It is important to provide for differentiation of true mental retardation from that simulated by emotional disturbances or by physically handicapping conditions of severe degree. In two hospitals, namely, the Bronx Municipal and the Brooklyn Jewish, cases diagnosed as not mentally retarded constituted approximately 27 per cent and 24 per cent, respectively, of those evaluated. Both clinics emphasize that they study the over-all field of child development. Indeed the name of the clinic at the Bronx Municipal Hospital, "Child Development

Table 2—Individuals* Seen in Selected Mental Retardation Clinics by Type of Previous Service† Received and Clinic—New York State, 1959

Type of Previous Service† Received	Individuals Seen in Mental Retardation Clinics													
	Total		Bronx Municipal Hospital		Jewish Hospital of Brooklyn		Flower-Fifth Ave. Hospitals		Shield of David Institute		Strong Memorial Hospital		Children's Hospital	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Number of individuals receiving one or more previous services	426	100.0	56	100.0	98	100.0	27	100.0	93	100.0	70	100.0	82	100.0
Diagnostic work-up in a mental retardation clinic	39	9.2	5	8.9	2	2.0	4	14.8	26	28.0	1	1.4	1	1.2
Pediatric clinic-services in mental retardation	63	14.8	11	19.6	1	1.0	6	22.2	40	43.0	4	5.7	1	1.2
Cerebral palsy clinic	35	8.2	—	——	17	17.3	—	——	2	2.2	3	4.3	13	15.9
Neurologic or convulsive seizure clinic	28	6.6	4	7.1	11	11.2	—	——	6	6.5	—	——	7	8.5
Speech and/or hearing clinic	41	9.6	4	7.1	10	10.2	2	7.4	10	10.8	8	11.4	7	8.5
Psychiatric or psychological services	174	40.8	12	21.4	53	54.1	8	29.6	18	19.4	38	54.3	45	54.9
Other services‡ (clinic or hospital)	18	4.2	3	5.4	4	4.1	1	3.7	6	6.5	2	2.9	2	2.4
Private medical consultations**	47	11.0	8	14.3	3	3.1	6	22.2	15	16.1	13	18.6	2	2.4
School or other training program	77	18.1	12	21.4	12	12.2	3	11.1	4	4.3	27	38.6	19	23.2
Case work, counseling§	34	8.0	7	12.5	18	18.4	1	3.7	—	——	6	8.6	2	2.4

NOTE: Percentages do not add up to 100 per cent as an individual may have had more than one previous service. However, individuals receiving the same service rendered by different individuals or agencies, are only counted once for that service.

* Of the 710 individuals reported as having been evaluated, rejected for service, or who withdrew from clinic, only 426 had received one or more services prior to coming to the clinic.

† Services with particular reference to mental retardation or for a condition associated with mental retardation, received prior to intake interview.

‡ Includes heart clinic, orthopedic clinic, clinic case work or counseling, and surgical services.

** Includes consultations by neurologists, orthopedists, pediatricians experienced in mental retardation, and physicians specializing in speech and/or hearing.

§ Provided by agencies other than clinics or hospitals.

Clinic," was designed to allow suspected cases to be referred without fear of a potential stigma which might be associated with the name "Mental Retardation Clinic."

The 482 cases diagnosed as mentally retarded were divided as follows: 163 educable; 188 trainable; 62 untrainable; and 69 had undetermined levels, reasons unstated.

The group classified as "not mentally retarded" had a median age of 7.4 years, two years more than that for all individuals diagnosed as mentally retarded, and 1.7 years more than that for those classified as "questionable." Similarly, the educable retarded had a higher median age, namely 6.5 years, than that of the other groups of retarded children.

4. Recommendations for Services

The clinics not only listed the services recommended for individuals completing their evaluation, but also indicated the availability status of such services. There were 1,334 recommendations made for 638 of the 655 evaluatees. Approximately 88 per cent of the recommended services were considered available, and 12 per cent were not so considered (Table 4).

The most frequently needed services were schooling or other training programs. Such facilities were either unavailable or unknown to be available for about 23 per cent of the individuals requiring them. Other recommended services or facilities which were frequently considered unavailable included psychiatric services, short-term residential care and treatment centers, institutions providing long-term care, and foster homes. On the other hand, such recommendations as medical supervision, neurological consultation, further psychological services, sight evaluation, speech and hearing evaluation and therapy, orthopedic consultation, physical therapy, casework, educational evaluation, and home evaluation were reported to be readily available to most of the evaluatees. However, it must be recognized that the participating clinics are located in areas where resources are apt to be more adequate than elsewhere.

5. Current School Status in Relation to Recommendations for School or Training Programs

A special concern of the study was an analysis of the relationship of current school status to recommendations for school or other training program (Table 5). Of the 655 evaluatees, 386 were of school age. At the time of the clinic evaluation conference approximately 54 per cent were in school and 46 per cent were not.

For 50 or about 45 per cent of the 111 individuals in regular classes, changes in training program were recommended. Of these, 27 were recommended for classes for the educable, eight for classes for the trainable, and practically all of the remaining 15 for socialization adjustment services.

Eighteen or about 27 per cent of the children in classes for the educable were deemed not suited for such classes. One was recommended for a regular class, five were recommended for classes for the trainable, and most of the 12 remaining individuals were recommended for adjustment services.

For the 29 evaluatees in classes for the trainable or in private schools for mental retardation, no significant changes were recommended. However, for one individual in the latter group, a change to a regular class was suggested.

When analyses were made of the group of 178 individuals of school age but not in school, it was noted that 29 were diagnosed as educable, 78 as trainable, 22 as untrainable, 16 as mental

Table 3—Individuals Evaluated in Selected Mental Retardation Clinics by Age and Mental Retardation Status—New York State, 1959

Age at Intake Interview (Years)	Mental Retardation Status of Individuals Evaluated															
	Total		Mentally Retarded										"Questionable"		Not Mentally Retarded	
			Total		Educable		Trainable		Untrainable		Level Deferred*					
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Number of evaluatees	655	100.0	482	100.0	163	100.0	188	100.0	62	100.0	69	100.0	84	100.0	89	100.0
0-1	47	7.2	35	7.3	6	3.7	8	4.3	4	6.5	17	24.6	9	10.7	3	3.4
2-3	134	20.5	112	23.2	22	13.5	49	26.1	22	35.5	19	27.5	13	15.5	9	10.1
4-5	180	27.5	140	29.0	46	28.2	56	29.8	18	29.0	20	29.0	24	28.6	16	18.0
6-7	132	20.2	93	19.3	31	19.0	42	22.3	11	17.7	9	13.0	16	19.0	23	25.8
8-9	66	10.1	39	8.1	18	11.0	14	7.4	4	6.5	3	4.3	10	11.9	17	19.1
10-11	49	7.5	31	6.4	18	11.0	10	5.3	2	3.2	1	1.4	8	9.5	10	11.2
12-13	32	4.9	21	4.4	16	9.8	5	2.7	—	——	—	——	1	1.2	10	11.2
14 and over	15	2.3	11	2.3	6	3.7	4	2.1	1	1.6	—	——	3	3.6	1	1.1
Median Age	5.6		5.4		6.5		5.3		4.6		3.8		5.7		7.4	

NOTE: Of the 710 individuals seen in the clinics, 655 were accepted and completed the work-up, 22 were accepted but withdrew, and 33 were rejected for service.
* Includes mental retardates whose functional level was unobtainable.

retardates whose functional level was unknown, and 33 as "questionable" or "not retarded." About 72 per cent of the educables were recommended for classes for the educable with all but one of the remaining individuals recommended for private schools for mental retardation or for adjustment services. Of the trainables, about 42 per cent were recommended for classes for the trainable, 42 per cent for private schools for mental retardation, and nearly all of the remainder for adjustment services. The reason that such a high proportion of the trainables were recommended for private facilities is mainly due to the fact that in Upstate New York there are few communities offering classes for the trainables.

Training recommendations for individuals diagnosed as untrainable, as would be expected, consisted of either private schools for mental retardation or a state institution. In no instance were adjustment services in a socialization program suggested. For retardates with functional levels unknown, trainable class recommendations were made for about 38 per cent of the children, with most of the remainder recommended for private MR schools or socialization activities. Of the 21 chil-

Table 4—Individuals Evaluated in Selected Mental Retardation Clinics by Type of Service Recommended and Availability Status of Such Recommendations—New York State, 1959

Type of Service Recommended	Individuals Evaluated in Mental Retardation Clinics					
	Availability of Services Recommended					
	Total		Obtainable		Not Considered Obtainable	
	No.	%	No.	%	No.	%
Total services recommended	1,334*	100.0	1,168	87.6	165	12.4
Further medical supervision	116	100.0	116	100.0	—	—
Neurological consultation	24	100.0	23	95.8	1	4.2
Psychiatric service	68	100.0	59	86.8	9	13.2
Further psychological service	40	100.0	40	100.0	—	—
Sight evaluation, therapy	20	100.0	20	100.0	—	—
Speech and/or hearing evaluation, therapy	142	100.0	134	94.4	8	5.6
Orthopedic consultation	16	100.0	16	100.0	—	—
Physical therapy	16	100.0	16	100.0	—	—
Case work, counseling	173	100.0	171	98.8	2	1.2
Educational evaluation	39	100.0	38	97.4	1	2.6
Schooling or other training program	492	100.0	380	77.2	112	22.8
Home evaluation and/or training at home	66	100.0	65	98.5	1	1.5
Residential care and treatment center (short term)	20	100.0	6	30.0	14	70.0
Institutionalization	49	100.0	36	73.5	13	26.5
Foster home	10	100.0	6	60.0	4	40.0
Other services†	43	100.0	43	100.0	—	—

* Total recommendations made for 638 of the 655 evaluatees.
† Services which were recommended for less than ten evaluatees. Includes recommendations such as cerebral palsy clinic, convulsive seizure clinic, heart clinic, dental care, special home equipment, hearing aids, and metabolic studies.

Table 5—Individuals of School Age Evaluated in Selected Mental Retardation Clinics by School Status* and School or Training Program Recommendation—New York State, 1959

School Status	Individuals Evaluated in Mental Retardation Clinics															
			School Placement or Special Training Recommendation													
			Public or Parochial School						Special Schools							
	Total		Regular Class		Educable Class		Trainable Class		Private MR		Other Disabilities		State School		Adjustment Services†	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Number of school age evaluatees	386	100.0	68	17.6	100	25.9	68	17.6	54	14.0	11	2.8	20	5.2	65	16.8
Individuals in School*																
Number in school	208	100.0	63	30.3	77	37.0	26	12.5	10	4.8	3	1.4	1	0.5	28	13.5
Regular class	111	100.0	61‡	55.0	27	24.3	8	7.2	—	—	1	0.9	—	—	14	12.6
Educable class	67	100.0	1	1.5	49	73.1	5	7.5	1	1.5	1	1.5	1	1.5	9	13.4
Trainable class	13	100.0	—	—	—	—	10	76.9	—	—	—	—	—	—	3	23.1
Private school—MR	16	100.0	1	6.2	—	—	3	18.8	9	56.2	1	6.2	—	—	2	12.5
Private school—regular	1	100.0	—	—	1	100.0	—	—	—	—	—	—	—	—	—	—
Individuals of School Age, Not in School*																
Number not in school	178	100.0	5	2.8	23	12.9	42	23.6	44	24.7	8	4.5	19	10.7	37	20.8
MR-educable	29	100.0	—	—	21	72.4	1	3.4	2	6.9	—	—	—	—	5	17.2
MR-trainable	78	100.0	—	—	—	—	33	42.3	33	42.3	—	—	1	1.3	11	14.1
MR-untrainable	22	100.0	—	—	—	—	—	—	6	27.3	—	—	16	72.7	—	—
MR-level unknown	16	100.0	1	6.2	—	—	6	37.5	3	18.8	—	—	2	12.5	4	25.0
"Questionable"	21	100.0	1	4.8	—	—	2	9.5	—	—	5	23.8	—	—	13	61.9
Not MR	12	100.0	3	25.0	2	16.7	—	—	—	—	3	25.0	—	—	4	33.3

* At time of the clinic evaluation conference.

† Includes aid in socialization given in community groups, at home, or in sheltered workshops.

‡ Includes 51 individuals diagnosed as not retarded, nine classified as "questionable," and one educable.

dren diagnosed as "questionable" about 62 per cent were recommended for adjustment services and 24 per cent were recommended for schools specializing in the training of individuals with disabilities other than mental retardation. In regard to the 12 children considered not retarded, three were recommended for regular classes, two for educable classes, three for special schools for disabilities other than mental retardation, and four for socialization activities.

6. Mental Retardation Prognosis

An evaluation of the patient's ultimate ability to function in the community as an adult was made by the clinics. These chances were considered nil or poor in about 25 per cent of all of the persons for whom such prognosis was listed (Table 6). All of the untrainable retardates, about 37 per cent of those retardates for whom the functional level was deferred and 24 per cent of the trainables, were considered in this category.

The prognosis was considered guarded in about 50 per cent of the individuals, and good in 25 per cent. For future planning it is imperative to determine to what extent these persons can remain in the community and to what extent will the existence of services help them to do so. This is a subject for long-term study.

Comments

In this report, we have presented the interdepartmental approach to the mental retardation problem being made in New York State as well as data from the diagnostic clinic phase of this work which will be useful in joint program planning.

All projects administered by the Interdepartmental Health Resources Board are reviewed regularly by the state departments concerned. In this way, evaluations may be made upon a multidisciplinary basis and the individual agencies may identify indicated needs for immediate action or future study.

It must be remembered that the findings reported by the mental retardation diagnostic clinics can be considered characteristic only of the children who come to the clinics and not of the entire population of retardates or suspected retardates. However, for these children, the following observations seem pertinent and concern several state and local agencies:

a. The need for the diagnostic centers has been verified by the paucity of adequate work-up of the children prior to coming to the clinics. There was minimal evidence of previous shopping-around from clinic to clinic for more favorable prognoses. In addition, the presence of sizable clinic waiting lists, with delays of from one to six months between application and intake, points to the need for some expansion of the capacities of the existing centers and to the development of a limited number of new centers in areas still without adequate service. In New York State, it is our plan at the end of the demonstration phase, to place these clinics under the community mental health services program, which is administered locally by the community mental health boards and at the state level by the Department of Mental Hygiene.

b. The age of patients seen at the clinics will influence the types of personnel needed. Although the demonstration centers had been requested to accept adolescent and adult applicants, only about 2 per cent of the individuals seen were persons 14 years of age and over. The majority of patients were under six years and the median age was 5.7 years.

c. The educable retarded had a median age of 6.5 years, 1.2 years

Table 6—Individuals Evaluated in Selected Mental Retardation Clinics by Prognosis* and Mental Retardation Status—New York State, 1959

Prognosis*	Total		Mental Retardation Status of Individuals Evaluated											
			Mentally Retarded										Not Mentally Retarded	
			Educable		Trainable		Untrainable		Level Deferred†		"Questionable"			
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Number of evaluatees for whom a prognosis was made	438	100.0	121	100.0	127	100.0	59	100.0	49	100.0	36	100.0	46	100.0
Nil or poor	110	25.1	—	———	30	23.6	59	100.0	18	36.7	3	8.3	—	———
Guarded	220	50.2	62	51.2	87	68.5	—	———	31	63.3	26	72.2	14	30.4
Good	108	24.7	59	48.8	10	7.9	—	———	—	———	7	19.4	32	69.6

* In regard to the individual ultimately functioning in the community as an adult.
† Includes mental retardates whose functional level was unobtainable.

higher than the median age for the trainable, 1.9 years higher than that for the untrainable, and 2.7 years higher than that for the mental retardates whose functional level was deferred. While it is readily recognized that evidence of retardation will be noted much earlier in more advanced cases, emphasis must be placed upon the earliest possible recognition of the less severely involved retardates. It is obvious that the earlier the offering of appropriate training and supportative services to parent and child, the greater the possibility of keeping the child in the community. This early recognition is a responsibility of all professional persons and agencies having direct contact with children and their parents, including physicians, clinics, social workers, and nursery and kindergarten teachers.

d. All children with mental retardation do not require highly specialized evaluation. This need for selectivity appears to have been recognized by the referring agencies, as a disproportionately low per cent of the less severe cases of retardation were seen at the clinics. Thus, while the ratio of educable to trainable retardates in the community has been estimated at about six to one,[2] the clinics evaluated slightly more trainables than educables.

e. Among the evaluated children attending regular classes 45 per cent were recommended for other schooling or training programs. Similarly, for approximately 27 per cent of the children in classes for the educable, changes to other training levels were recommended.

Of the 178 school-age children not in school, 29 were considered educable and 78 as trainable. About 72 per cent of the educables were recommended for classes for the educable, and 85 per cent of the trainables were recommended for classes for the trainable. Obviously, these findings are of considerable concern to the Department of Education.

f. One or more recommendations were made for the vast majority of persons evaluated at the clinics. Schooling or other training programs, speech and hearing evaluations including therapy, and case work and counseling were the most frequent services recommended. While most of the recommended services were reported to be available, there appears to be a need for additional facilities and services including schooling or training, psychiatric services, short-term residential care and treatment, institutionalization, and foster or guardian care. However, it must be remembered that the clinics participating in the study are located in areas where services are more apt to be available than elsewhere.

g. The prognosis for ultimately functioning in the community as an adult was considered good in about 25 per cent of the evaluatees for whom such prognosis was made, poor in another 25 per cent, and guarded in 50 per cent. It is this last group which requires the greater number of services. The ability of the state and local agencies to provide these services will greatly influence the proportion of retardates that stay in the community and will not require placement in institutions.

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This study reports an outbreak of illness associated with prophylactic inoculation against rabies, and shows it to have been due to the virus of infectious canine hepatitis.

INFECTIOUS CANINE HEPATITIS COINCIDENTALLY ASSOCIATED WITH VACCINATION AGAINST RABIES

Orland A. Soave, D.V.M., and Edwin H. Lennette, M.D., Ph.D.

DURING the latter part of December, 1957, and the first half of January, 1958, approximately 1,200 dogs from Santa Cruz County, Calif., were inoculated with chicken embryo rabies vaccine made from the Flury strain of virus in low egg passage. Approximately 1,000 of these dogs were inoculated in special vaccination clinics; the remainder, in local veterinary hospitals.

Of the total number of animals vaccinated, 34 became ill from 5 to 18 days after inoculation and 14 died. The clinical picture seen in the affected animals was indistinguishable from that described for infectious canine hepatitis.[1,2]

Because of the widespread prophylactic use of living attenuated rabies virus in the form of low egg passage Flury strain, health authorities and veterinarians alike were interested in the relationship of the vaccine, if any, to the postvaccination illnesses in the dogs. Vaccine produced by a single manufacturer had been used exclusively in the vaccination clinics and to a large extent in the private hospitals. Sample lots of vaccine* were tested bacteriologically and found to contain large numbers of Pseudomonas spp.† Virologic and pathologic inquiries were also undertaken and the results of these investigations are presented in this paper.

Material and Methods

Preparation of Dog Tissues for Histopathologic Examination—Liver, spleen, kidney, and lung specimens were obtained from two of the dogs succumbing to the disease. The specimens were fixed in 10 per cent formol solution containing 2 per cent sodium acetate, processed through the usual dehydrating reagents and embedded in paraffin. Sections were cut on a rotary microtome and stained with hematoxylin and eosin.

Preparation of Vaccine Specimens—Several vials of vaccine bearing lot numbers implicated in the postvaccination episode were selected at random for examination. The lyophilized vaccine was reconstituted in distilled water to give the equivalent of a 33 per cent suspension of virus and the resultant suspension was centrifuged in a refrig-

* We are indebted to George L. Humphrey, D.V.M., Bureau of Acute Communicable Diseases, California State Department of Public Health, for obtaining the sample lots of vaccine.

† The bacteriologic studies were conducted by Alcor S. Browne, Ph.D., chief, Bacteriology Laboratory, Division of Laboratories, California State Department of Public Health.

erated centrifuge for one hour at 2,500 rpm in order to produce a relatively bacteria-free supernatant fluid that could be examined by tissue culture methods. Three different lots of vaccine were so processed; 0.01 and 0.1 ml amounts of supernatant fluid of each lot were inoculated into monolayer cultures of dog kidney cells (see below); eight culture tubes were used for each lot of vaccine, four tubes receiving the smaller inoculum and four the larger inoculum.

Tests for Rabies Virus—Brain tissue from the two dogs mentioned above was examined for the possible presence of rabies virus. Smears were made from several areas, including the hippocampus, and stained by Seller's[3] method. A one gram portion of the brain was ground in a mortar and made into a 10 per cent suspension by the incremental addition during grinding of 0.85 per cent saline solution. This suspension was centrifuged for ten minutes at 2,500 rpm and the supernatant fluid removed. Sufficient penicillin and streptomycin were added to give concentrations of 1,000 units per ml and 5,000 units per ml, respectively; the treated mixture was held at room temperature for 30 minutes and then inoculated intracerebrally in 0.03 ml amounts into albino Swiss mice. A group of six mice was used for each brain suspension.

Preparation of Dog Tissues for Tissue Culture Studies—Specimens of liver, spleen, kidney, and lung from the two dogs were prepared for inoculation into dog kidney cell cultures by the following procedure. Approximately one gram of tissue was ground in a mortar with alundum and made into a 10 per cent suspension in 0.85 per cent saline solution. The suspension was centrifuged at 2,500 rpm for ten minutes and the supernatant fluid was carefully removed. Penicillin and streptomycin were added in sufficient amounts to give final concentrations of 1,000 units and 5,000 units, respectively, per ml. The treated mixture was allowed to stand for 30 minutes at room temperature and then inoculated into cultures of dog kidney cells. The inoculum consisted of 0.01 ml and of 0.1 ml amounts, each volume series being inoculated into a group of four culture tubes.

Preparation of Cultures of Dog Kidney Cells—Dog kidney was obtained from a young animal approximately eight weeks of age. The kidneys were removed aseptically and finely minced with scissors. The mince was washed several times with Hanks's balanced salt solution and then digested with 0.25 per cent trypsin in Hanks's solution; digestion was carried out overnight at 4° C, continuous agitation being provided by means of a magnetic stirrer. Trypsin was removed from the cell suspension by several washings with Hanks's solution, light centrifugation (200-500 rpm) for several minutes being employed.

On the final washing, the cell suspension was placed in 15 ml centrifuge tubes and centrifuged horizontally for ten minutes at 1,000 rpm. The supernatant fluid was discarded and the cell pack was diluted 1:200 in an outgrowth medium consisting of 10 per cent inactivated horse serum, 10 per cent lactalbumin hydrolysate solution (5 per cent solution in phosphate buffer), 80 per cent Earle's balanced salt solution and sufficient 2.8 per cent sodium bicarbonate solution to give a final pH of 7.6. Phenol red (1.0 per cent) was added in the proportion of 1.6 ml per liter of medium. Penicillin, streptomycin, and neomycin were also added, the final concentration of each being 250 units per ml.

Monolayer cultures of dog kidney cells were prepared in tubes; the cell suspension was distributed into a series of tubes in one ml amounts, the tubes were closed with white nontoxic stoppers

and set to incubate at 37° C in stationary racks. The outgrowth medium was removed at the end of 48 hours and replaced with fresh outgrowth medium and the tubes were incubated for an additional 72 hours. A solid sheet of cells was usually present by this time and the outgrowth medium was replaced with two ml of maintenance medium composed of Earle's balanced salt solution, 50 per cent; Medium 199 in Earle's solution, 25 per cent; and Hanks's balanced salt solution, 25 per cent. The medium was buffered to pH 7.6 by the addition of 2.5 per cent of 8.8 per cent sodium bicarbonate. Antibiotics were also added to give the following concentrations: penicillin, streptomycin and neomycin, 250 units of each per ml; bacitracin, 2.5 units per ml; and mycostatin, 50 units per ml. The tubes were then inoculated using 0.01 and 0.1 ml amounts of inoculum, as indicated elsewhere.

Experimental

Histopathologic Examination — At autopsy, the gross findings in the two dogs on which the present inquiry is based consisted of large amounts of a serosanguinous fluid in the abdominal and thoracic cavities; subserous hemorrhages in the stomach and intestinal walls; blood in the intestinal tract, together with evidence of a generalized gastroenteritis; and a swollen and dark colored liver. One animal showed an extensive edema of the thymus gland and the other a large area of subcutaneous edema in the abdominal wall.

Microscopically, the most striking finding was the presence of intranuclear inclusions in the hepatic cells. A large number of Kupffer cells were in various stages of degeneration. Perivascular and periportal infiltration by lymphocytes and polymorphonuclear cells was present. The changes observed in other tissues consisted of degeneration of the epithelium of the collecting tubules of the kidneys, slight interstitial edema in the lungs, and congestion of the spleen.

The pathologic changes observed were thus consistent with those associated with infectious canine hepatitis.

Tests for Rabies Virus—Inasmuch as the affected animals had been inoculated with living, albeit attenuated, rabies virus, there arose the obvious question as to whether this virus might have been responsible for the illnesses which occurred in these animals subsequent to vaccination, i.e., a cause and effect relationship. Smear and imprint preparations from the brains of both dogs were stained by Seller's method for Negri bodies; extensive microscopic examinations of the preparations failed to reveal the presence of Negri bodies. Mice inoculated with brain suspensions from these two animals did not show any overt evidence of infection over the four weeks observation period. The results of both diagnostic tests were thus negative and in essence ruled out rabies virus as a causal factor in the illness.

Tests for the Presence of a Viral Agent in the Vaccine—Vials representing aliquots of each of the three lot numbers of vaccine were selected at random and the lyophilized vaccine reconstituted and processed as described above. The vaccine preparations were then inoculated into dog kidney cell cultures as this is the method of choice for the isolation of the virus of infectious canine hepatitis.[4] At the primary passage, aliquots representing each of the three lot numbers were inoculated into monolayer cultures in 0.1 and 0.01 ml amounts, four tubes being inoculated with each volume of inoculum. The inoculated cultures were held for seven days after which two additional tissue culture passages were made, 0.1 ml amounts of tissue culture fluid being used as the inoculum on each occasion.

The second and third passage cultures were held for seven days (or until nonspecific degeneration began to appear) and then discarded. No evidence of a cytopathogenic agent was obtained during the course of three passages of the incriminated vaccines.

Recovery and Identification of Infectious Canine Hepatitis Virus from Dog Tissues—Spleen, liver, kidney, and lung tissue from both dogs were inoculated into monolayer cultures of dog kidney cells. None of the tissues from one animal (Dog 2) produced cytopathogenesis during the course of three blind passages and so presumably did not contain an agent, or at least demonstrable amounts of an agent, cultivable in the host cell system used.

Cultures inoculated with the spleen, liver, kidney, and lungs of Dog 1 all showed evidence of marked cellular destruction within 48 hours, irrespective of whether they had been inoculated with 0.1 or 0.01 ml of tissue suspension; by 96 to 120 hours the cytopathic effect progressed to a complete cellular destruction of the cultures. Since it appeared reasonable to assume that the cytopathogenic agent isolated from the four tissues represented a single agent rather than several, the strain isolated from the spleen suspension was selected for further work.

The third passage tissue culture fluid of the spleen strain was titrated in monolayer cultures of dog kidney cells. Serial tenfold dilutions of infected culture fluid ranging from 1×10^{-1} through 1×10^{-8} were prepared in Hanks's solution; each dilution was inoculated into four tubes of monolayer kidney cells using 0.1 ml volumes. The 50 per cent tissue culture dose (TCD_{50}) of the virus, computed by the method of Reed and Muench,[5] was found to be 1×10^{-5}.

Identification of the virus was accomplished in a block neutralization test utilizing a known immune serum against canine infectious hepatitis virus. The serum employed was actually a fox hyperimmune serum, kindly furnished by Dr. Herald R. Cox. The neutralization test was set up as follows. Serial tenfold dilution ranging from 1×10^{-1} through 1×10^{-5} were prepared in Hanks's solution. The fox hyperimmune serum was inactivated at 56° C for 30 minutes and used to prepare a series of twofold dilutions in Hanks's solution, the last dilution of the series being 1:128. The viral dilutions employed covered the range 1×10^{-2} through 1×10^{-5} and the serum dilutions employed covered the range 1:16 through 1:128. To 0.5 ml amounts of virus dilution were added 0.5 ml amounts of serum dilution; the mixtures were then inoculated into dog kidney cultures using 0.1 ml of inoculum per tube and four tubes for each serum-virus mixture. The results of the block titration are given in Table 1, which shows that each virus dilution was, in essence,

Table 1—Identification of Agent as Virus of Infectious Canine Hepatitis

Virus Dilution	Cytopathogenesis in Dog Kidney Cell Cultures in Presence of Immune Serum Diluted				
	No Serum	1:16	1:32	1:64	1:128
No virus	—	0*	0	0	0
10^{-2}	4+†	0	0	0	0
10^{-3}	4+	0	0	0	0
10^{-4}	4+	0	0	0	0
10^{-5}	4+	0	0	0	0

All readings made at seven days postinoculation of cultures.
* 0 = No cytopathogenic effect, i.e., virus neutralized.
† 4+ = Complete degeneration, i.e., viral activity.

tested against each serum dilution. It will be seen that virus without the immune serum produced cytopathogenic changes throughout the dilution range covered, i.e., through the 1×10^{-5} dilution. However, virus in the presence of the immune serum was neutralized, since cytopathogenic changes were not found in any of the tubes inoculated with serum-virus mixtures; even a 1:128 dilution of the serum protected against the 1×10^{-2} dilution of virus, i.e., against 1,000 to 10,000 TCD_{50} of virus.

The clinical signs in the dogs, the pathologic changes produced in the animals and the behavior in dog kidney cell culture of the agent recovered from canine tissues suggested that the virus of infectious canine hepatitis was being dealt with. The results of the neutralization test served to confirm this original impression.

Discussion

The episode described here is not an isolated one since a similar incident occurred in California in 1955 and also involved a low egg passage vaccine containing the Flury strain of rabies virus. The vaccine used at that time had been produced by a different manufacturer and was also found to be heavily contaminated with Pseudomonas spp. The illnesses and deaths which occurred among the vaccinated dogs in the 1955 episode were also thought to have been caused by the virus of infectious canine hepatitis, but no etiologic investigations were undertaken.

The importance of such incidents to the health officer and to the veterinarian lies in the conclusion reached by the public that there exists a cause and effect relationship between the prophylactic inoculation of the animal against rabies and a subsequent occurrence of illnesses and even deaths in the vaccinated animal population. If the Flury strain vaccine played any direct role in the outbreak of illnesses described here, it is by no means clear. The laboratory evidence points away from rabies virus as etiologically responsible for the illnesses produced in the dogs and there is no reason to believe that the Flury virus, at a low egg passage level and virtually apathogenic, suddenly developed virulent propensities in the animals which were affected.

The available evidence suggests that the illness was not conveyed to the dogs by way of the vaccine since attempts to recover the infectious canine hepatitis virus from the vaccine were negative. This is strong presumptive, not conclusive, evidence that the vaccine was free of the hepatitis virus. It would seem likely that among the animals brought together by the immunization clinics, there might well have been a number of carriers of the hepatitis virus; since the agent is shed in the urine,[6] dissemination of the virus via contacts at the clinics is an obvious possibility.

Whether inoculation with the vaccine predisposed some of the animals to infection with the hepatitis virus, i.e., constituted a stress factor, is uncertain; this would be a moot point in the light of current information even if the vaccine were known to contain a single microorganism, viz., the rabies virus. However, the incriminated vaccines, both in 1955 and in 1957, contained large numbers of Pseudomonas spp. so what possible contributory effect each agent might have in lowering the resistance of the animal to the hepatitis virus becomes more difficult to determine.

Even if the Pseudomonas organism is relatively nonpathogenic for the dog as a primary incitant of disease, it may conceivably exert some adverse effect on the animal's resistance to infection with known pathogens. If the administration of a vaccine constitutes in itself a stress factor which may, in some degree, alter

resistance to infection, then it would obviously seem desirable to keep specific vaccines free of contaminating microorganisms. Aside from the economic considerations, which are relatively minor, there appears to be no good reason why biologic products for veterinary use should not meet the same high standards applied to similar products employed in human medicine, at least in so far as freedom from contaminating microorganisms is concerned.

Summary

An outbreak of illness associated with prophylactic inoculation against rabies is shown to have been due to the virus of infectious canine hepatitis. The virus was recovered by inoculation of monolayer cell cultures of dog kidney with suspensions of tissues from sick dogs.

The vaccine employed consisted of low egg passage Flury strain virus. The three incriminated lots of vaccine tested did not contain demonstrable hepatitis virus and the outbreak is attributed to infected dogs among the large numbers that were inoculated at the various immunization clinics.

There was no evidence that the attenuated rabies virus in the vaccine was etiologically involved. The undesirability of using vaccines contaminated with extraneous microorganisms is discussed.

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Journal of Public Health

EDITORIALS

Research in Cardiovascular Diseases

With the progressive control and diminishing significance of acute communicable diseases in the United States, chronic conditions have emerged as major public health concerns and are receiving increasing emphasis. The two principal causes of death in this group are cardiovascular diseases and malignant neoplasms. One may therefore expect that major future reductions in the death rates will come from success in dealing with heart disease and cancer, and not from further reductions in mortality due to tuberculosis or pneumonia.

At the same time, one must recognize that while the resources for studying and combating many diseases are today greater than ever before, the experience of the past is only partly pertinent to the problem of the chronic diseases though some of the factors which affect the occurrence and control of communicable diseases may prove to be of importance for the chronic diseases. Future research will very possibly reveal biological and chemical aspects of which we are still ignorant. Such knowledge must come, of course, from research and research is the hope of the future. Meanwhile, a great deal is being done, for example, in the investigation of cardiovascular diseases. This wholesome trend, however, poses certain problems that must be faced. For one, as knowledge increases rapidly in a variety of research areas, this trend forces investigators to take stock of what is going on, and to appraise the methods by which knowledge is being advanced.

With such an objective the American Heart Association and the National Heart Institute convened a Conference on Methodology in Epidemiological Studies on Cardiovascular Diseases. This meeting was held at Princeton, N. J., April 24-26, 1959. The co-sponsoring organizations felt that it was now time to analyze specifically problems of methodology and specifically precise measurements that might be used to achieve comparability among studies being carried on by different investigators. The results of this conference are now available in the supplement issue of this Journal. Readers of the Journal will, of course, form their own judgments as to significance of this publication.

It is our opinion, however, that the report of the conference reflects an increasing degree of sophistication and maturity in research on the epidemiology of cardiovascular diseases. This augurs well for the future. While philosophy is at best a thankless task one cannot help but feel this report is a milestone on the road to the ultimate control of an extremely important public health problem.

Liberal Education and Public Health

AMERICANS are today engaged in a debate on education, a debate which sometimes waxes acrimonious and hysterical, but which even in a quieter vein continues with vigor. The issues involved in this debate concern the respective merits of scientific and technological studies on the one hand and liberal studies on the other, as well as the relationships which should exist between them. Although these issues concern education at all levels, some of the more urgent problems as viewed by many thoughtful persons are related to higher education as carried on in colleges and universities.[1] Stimulated by advances in science and technology, both in the United States and in other parts of the world, many advocate an intensification of professional and technical training so as to turn out the highly trained personnel required in the specialized vocations of a complex industrial and technological society. There are others, however, who stress a liberal education as having especially pertinent values in the modern world.

While the issues involved in these questions extend far beyond the boundaries of education for professional public health work, there can be no doubt that these issues do concern us. For example, in the June number of the Journal, Dr. Callister[2] raised the question: Quo Vadis—Public Health? and pointed out that "The future of public health may well lie in the relationship of socioeconomic problems to the incidence and nature of illness, and conversely, from a constructive viewpoint, what can be done at a community level to best meet illness problems arising from socioeconomic factors. The training devices needed are better backgrounds in socioeconomics and business administration among medical directors."

There can be no argument on this score. As new problems arise and new knowledge with which to meet them is obtained, the curriculums must of necessity be altered. Innovation in substance is essential if a professional curriculum is to remain vital. Education for professional public health work must rest on a solid, but continually growing basis of knowledge and its application in practice. But is this enough? In view of the enormous volume and rapid growth of knowledge in the fields of public health, the student within the time available (most generally one academic year) can properly be expected only to become acquainted with basic principles and currently accepted operating technics of the various disciplines, with the probability that the latter may soon become outdated, exerting a factor in the educational process. Equally important, therefore, is how this knowledge, these principles and facts, are taught to the student. One should not forget (indeed, how can one forget?) that in teaching the disciplines of public health we are dealing with the products of a culture, with the history of ideas, the evolution of technology, with social philosophies—in short, with the sum of the products of human creativity and ingenuity. If the student can be equipped with fundamental knowledge, with the skills re-

quired to put this knowledge to practical use, and if he can be helped to formulate a philosophy in terms of which the purposes and activities of his professional existence may be given meaning, then the school of public health has fulfilled its function in giving the student not only competent training but also a comprehensive education.

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"Fraught with Terror—and with Hope"

"In recent years it has been accepted that nucleic acid is the guiding factor in genetics, and work on bacterial viruses has produced evidence to substantiate this.

"The world at large is not yet aware of what this means. That we have reached the point where we can study life in terms of molecules is in itself a marker of history bearing more weightily on human destiny than the hydrogen bomb or our rockets into space. Ultimately the consequences—for good or ill—are likely to be greater.

"Much if not all of mankind's illness is due to sick cells, and much of this sickness is due to nucleic acid having gone bad. Since man can manipulate the nucleic acid in naked nuclei . . . it is not too much to expect that some day he will manipulate the nucleic acid in whole cells in intact living bodies.

"This means that those who come after us will be able to decide, to some degree as yet immeasurable, what kind of human beings will inhabit the earth. It is a contemplation fraught with terror—and with hope. Will these controls fall into the hands of individuals or groups unable to use them wisely and morally? If so, the dreary world imagined by George Orwell . . . will seem by comparison mere child's play. On the other hand, those same controls will enable coming generations to prevent or alleviate much human suffering, sickness and disability." (Thomas M. Rivers, M.D., vice-president for medical affairs, The National Foundation, in "The National Foundation Annual Report 1959.")

ROLE OF PUBLIC HEALTH AGENCIES IN AIR POLLUTION CONTROL

Report of the Air Hygiene Committee, Engineering and Sanitation Section, American Public Health Association

EXPANDING public and official interest in air pollution and its control has been recognized by the American Public Health Association. Two years ago the Engineering and Sanitation Section Council charged the Air Hygiene Committee to "Define the role of federal, state, and local health services in air pollution control activities with emphasis on administrative relationship between agencies and legislative and regulatory aspects." This report represents the work of the Air Hygiene Committee over the intervening period. The committee has defined "Air Pollution" as the presence in the outdoor atmosphere of one or more substances in quantities, of characteristics and of durations which are injurious to the health of man or which interfere with his comfort, safety, or with the full use and enjoyment of his property.

To the many health officials who are faced with the determination of the role in air pollution control which their agency will serve, this report may help to provide a perspective. For the public and other government officials, an insight may be offered to the administrative considerations associated with the assignment of official responsibility for air pollution control. It is not the purpose of this report to advance the public health agency as the only unit of government capable of coping with air pollution; however, inherent advantages of locating air pollution control activities in the public health orbit are indicated.

That excessive air pollution constitutes a public health problem can no longer be denied. Acute episodes of air pollution accumulation have been so considered for a number of years, but only recently have the more subtle effects of low levels of endemic exposure received attention of public health epidemiologists.

Dixon[1] has summarized succintly the concern of public health workers with air pollution as follows:

"Leaving aside any considerations that the air transports allergens and radioactive particles, it is clear that, under some circumstances acute air pollution can cause death among older persons and can cause serious illness to others. At least in the instance of chronic bronchitis there is a direct relationship between air pollution and a specific disease. In addition, we know that air pollution can cause temporary disability through eye irritation. But a direct relationship has not yet been demonstrated between air pollution and other diseases that are apparently incident to urban living, although the available evidence supports a strong suspicion that air pollution may play a role, if only a synergistic one, in the development of these diseases, including lung cancer.

"The field of public health throughout its entire history has frequently had to operate from generalizations and has developed control measures for diseases even when the specific etiology of a disease was not known. From the point of view of health protection, therefore, our present state of knowledge is sufficient to stimulate a fundamental concern about the relationship of air pollution and health. . . .

"If gas masks are not to become as common in a hundred years as shoes are today in the civilized world, we should do well to heed our somewhat submerged instincts of self-preservation and remember that—whatever other uses man may devise for it—air is still essentially for breathing."

Government

Protection of persons from the adverse results of air pollution, be they health, social, or economic effects, is a responsibility of government. Included in this responsibility is the research necessary to define the air pollution problem, including conditions and their effects, and to determine measures or methods to accomplish any necessary control.

Consistent with policies advocated by the American Public Health Association with respect to the organization of other health services, this committee subscribes to the thesis that enforcement of laws designed to control polluting emissions from specific sources can best be accomplished at the lowest level of government capable of effective action. In practice this means that the area for operations must be of sufficient size and of such characteristics that the control of sources of emission within the area will substantially eliminate air pollution from the area. Also, the coverage must rest on a population and economic base capable of financially supporting a competent staff and required services.

Air pollution has been recognized as a problem of increasing significance to the health of the nation. Further the degradation of communities ensuing as an aftermath of excessive air pollution saps the nation's social and economic vitality. As such, it demands the most effective use of the resources of all levels of government. Delineation of how these services may best be coordinated and utilized is the purpose of this report.

The Role of Federal Agencies

The federal role in solving air pollution problems is primarily to do those things which may be done more effectively and economically by a central agency than separately by fifty states and several thousand cities. The two areas in which the need for centralized effort is most apparent are research and training. The federal government should therefore undertake research in areas or fields where the implications are nation-wide in scope or which local agencies are unable to support because of the magnitude of the problem and the limitations of budget and staff. Further, it should provide the means for training personnel needed by states and communities for their air pollution control activities.

To accomplish these objectives, the federal government should operate laboratories of its own for some research purposes; and for other purposes it should provide research grant support to universities and research institutes. Similarly, the federal government should provide funds to universities to establish broader training programs and provide its own centralized training facility for the types of short courses that universities are not geared to handle. The training provided by universities with such support should be aimed at producing both engineers for air pollution control work and more scientists to undertake needed research in air pollution.

A second role of the federal establishment should be to provide centralized services to states and communities through the dissemination of air pollution information and the provision of consultative and laboratory services to state agencies, and, through state agencies, to local agencies. The dissemination of air pollution information should include collection and publication of basic data regarding such matters as air quality, air quality standards, air pollution transport, effects of air pollution, costs of air pollution, methods of air pollution sampling, and measurement and methods of air pollution control. In addition, the federal agencies

should undertake to prepare for use by states and communities in their local public education activities audiovisual materials in the form of leaflets, films, radio and television scripts, posters, and training manuals.

Consultative services to state and local agencies should be on technical matters in which the federal agency has special competence or the state or local agency lacks competence. Legislative and regulatory matters are another area in which the federal agency should accumulate information from many states and communities for the benefit of those seeking such information. Likewise, where federal agencies have acquired expensive and unusual chemical and physical analytical equipment not likely to be found in state or local laboratories, these facilities should be placed at the service of state and local laboratories as feasible.

A nation-wide problem such as air pollution needs periodic nation-wide review and appraisal, so that the status of future needs may be evaluated. This should be accomplished by the federal agencies involved sponsoring national conferences or symposia, and conducting special studies and surveys. State agencies often find it valuable to have a federal agency review their program and work with them in planning for the solution of state-wide problems, and this is another role for the federal agency in the air pollution field.

Lastly, there are the operational activities which, for specific reasons, are best handled by a federal agency; for instance, participation on behalf of the United States in studies of international transport of air pollution across our Canadian or Mexican borders, and the control of air pollution from federal installations. It has become apparent that such wide-scale phenomena as weather prediction requires federal coordination because the scale of weather is greater than the breadth of any one state. Since air pollution is by and large a function of the weather, it becomes a federal responsibility to provide the meteorological services necessary to meet the needs of state and local agencies in the prediction, explanation, and understanding of air pollution episodes.

One area in which there is a definite federal concern, but little agreement as to how this concern should be exercised, is that involving interstate air pollution problems. Such matters preferably should be handled by interstate cooperation. However, it is evident that where one state refuses to cooperate, this type of solution will fail. In such situations, it would be desirable for the U. S. Public Health Service to make investigations at the request of the aggrieved state, or to assist the aggrieved state in its own investigations, and to hold public hearings to develop recommendations. Such recommendations, while not binding upon the participants in the hearing or anyone else, would be a means of focusing public attention on and developing support for carefully considered solutions to the problems.

There are several federal agencies whose sphere of interest concerns them with one or more phases of the air pollution problem. Thus, the Bureau of Mines is interested in air pollution through fuels and their combustion, since a large proportion of air pollution is attributable to such sources. The Department of Agriculture is specially interested in air pollution damage to crops and livestock. The Weather Bureau has a logical interest in the measurement and prediction of meteorological factors which are responsible for the transport of pollutants. The Bureau of Standards is traditionally concerned with basic research into the fundamental principles of physics and chemistry which are vital to a better knowledge of air pollution. The Depart-

ment of Defense needs much background information as to the pollution of the atmosphere and the transport of pollutants, in order to defend the United States against attack by airborne chemical, biological, and radiological agents. The Atomic Energy Commission, having assumed responsibility for nuclear explosions which have thrown considerable radioactive material into the atmosphere, has a continuing concern for the fate of these radioactive particles for the rest of their life history. Both the Department of Defense and the agencies concerned with civil aeronautics have an interest in visibility along airways and at airports.

Since a large number of federal agencies have an interest in the air pollution problem, the federal attack on it requires careful coordination of their efforts. Congress has selected for this job the Public Health Service of the U. S. Department of Health, Education, and Welfare because this agency has a broad interest in the effect of environmental factors on the health of the nation. The role of the Public Health Service has been, therefore, to provide the basic federal framework and facilities for air pollution research and training; to provide the mechanism for research and training grants to universities; and to make the necessary commitments to other federal agencies so that all available federal talent may be utilized in attempting to solve the nation's air pollution problem. However, over and above its role as coordinator, researcher and trainer, the Public Health Service, by virtue of the implications of the impact of polluted air on the health of the nation, has the still more important role of providing vigorous and active leadership in the definition of the problems of air pollution, their effects upon health and feasible methods of control.

In addition to the duties of agencies of the federal government, there are a number of national professional organizations, such as the American Public Health Association that share responsibilities in problems of air pollution and its control. Concern of these professional groups is manifest principally in the collection, evaluation, and dissemination of technical data and information, the sponsoring of conferences and symposia, and the establishment of standards. Currently, there is great need to establish tolerance standards for contaminants in community air and uniform test procedures to detect and measure such contaminants. This question should be resolved by joint action of the national professional organizations and government agencies.

The Role of State Agencies

Under the United States Constitution the police power to protect the public health and safety rests with the state except for delegations of part of this authority by the state to cities and counties. Most state legislatures have delegated to cities and counties (and sometimes special districts) authority to enforce statutes and to adopt and enforce local ordinances for the control of air pollution. The following discussion is predicated on the assumption that this type of delegation has been made.

There are, in most states, four major state agencies which have sizable responsibilities in the air pollution field. They are: The Legislature, the Governor's Office, the State Department of Public Health, and the State University. The principle responsibilities of each are as follows:

The Legislature—has the responsibility for enacting legislation which clearly defines the authority of respective state and local official agencies in the field of air pollution control, and which indicates in sufficient detail to

be clearly understandable the methods by which air pollution control shall be carried out at the state and local levels. Such legislation should indicate the method of financing activities of city, county, and district agencies at the local level.

The legislature should indicate which agencies in the state have a responsibility for conducting research on air pollution, and, if state funds are to be utilized for supporting such research, the legislature should indicate by whom the funds are administered and the general terms of allocation or subsidy.

The Governor's Office—The governor, as head of the executive arm of government has the basic responsibility for seeing that the state agencies under his control properly administer the provisions of the legislation pertaining to air pollution.

It is the governor's responsibility to secure and maintain proper coordination of air pollution activities among state departments.

It is the responsibility of the governor's office to submit to the legislature and support adequate budgets for the air pollution research and investigation and control activities of the state agencies. In most states it is the responsibility of the governor to declare a "State of Emergency" and to take command of emergency activities on the occurrence of an air pollution disaster with which it is beyond the capabilities of local agencies to cope.

The State Health Department—is in most states the state agency delegated major responsibility for administration of the air pollution control program. Since the health department is the agency responsible for control of other environmental factors that affect the life and health of man, this assignment fosters efficiency through coordination with other related activities. Physical, chemical, and biological laboratories already provided may be utilized in the air pollution control program. Furthermore, the state health department is usually the only state agency staffed with experienced epidemiologists accustomed to evaluating the health significance of environmental conditions prevailing in that state.

Generally speaking, the responsibilities of the state health department include all aspects of the air pollution control program except those relating directly to enforcement of control regulations. Where states are organized for administrative decentralization through state districts or regions, such offices may perform many of the state functions. Where state legislatures authorize a group of contiguous municipalities and counties to form an air pollution control district, the activities are more nearly those of a local agency and are discussed in that portion of this report.

Among the principle responsibilities of the state health department are the following:

(a) Carrying out of general over-all investigation, analysis, and interpretation of the air pollution problem in the state.

(b) Securing long-range planning of state agencies and local communities for the study, prevention, and control of air pollution.

(c) Securing the establishment of and taking a principal part in a state-wide program of systematic surveillance of air quality.

(d) Maintaining surveillance of effects of polluted air on the exposed population.

(e) Carrying out special studies of emergency episodes of air pollution.

(f) Developing general plans for coping with emergencies and disasters with attention to such factors as medical treatment of casualties, emergency environmental protective measures and remedial measures to restore safe ambient air quality.

(g) Advising local agencies on control programs and where control activities are needed, foster development of effective programs at lower levels of government.

(h) Rendering technical assistance to local agencies in their control programs.

(i) Providing technical inservice training to staff of local air pollution control agencies.

(j) Carrying out in specific communities demonstrations of the principles, technics, and equipment used in local control programs.

(k) Studying special problems of air pollution.

In addition to the foregoing functions of a state health department, which are generally applicable to any state, are the following: It is generally recognized that in some states, such as California, problems may become so critical that it is necessary for the state health department to carry out functions which in the usual course are logically performed by the federal government. Included in this category are the promotion and carrying out of a broad program of medical research on the effects of polluted air on human beings and the development of standards of quality of community air concerned with (1) disaster conditions; (2) occurrence of acute or chronic disease; and (3) lowered human performance or impaired comfort and enjoyment.

In such unusual cases the state health department may also face the necessity of establishing standards for specific types of emission, such as from motor vehicle exhaust, which would normally be the responsibility of the local agency adopting regulations as the basis of an enforcement program. Where air pollution problems transcend the state boundaries, the state agency may negotiate an effective over-all solution with adjacent states.

The State University—has two basic types of responsibility. As it is an educational institution it has a responsibility to provide a high quality of higher education in the field of air pollution control to its students, both undergraduate and graduate; being a state-supported institution it has a responsibility to assist in solving the pressing problems of the state, including that of air pollution.

For both of these functions, the university must keep abreast of the status of working knowledge on the medical, engineering, and other aspects of community air pollution, and seek to expand and refine this working knowledge.

Therefore, the state university has a responsibility for planning and carrying out needed medical, engineering, botanical and meteorological research relating to the causes, effects and remedies of air pollution. The university, furthermore, has a responsibility for incorporating the principles and working knowledge on air pollution into the curriculum of its engineering, medical, chemical, agricultural, public administration, and public health courses. Other private educational institutions may offer valuable teaching and research facilities which could be similarly utilized by industry and government to supplement their own resources.

The Role of Local Agencies

Control of air pollution by local jurisdictions is a delegation of inherent state police power. This delegation should be made by state law in recognition of the desirability of programing and enforcement at the lowest level of government capable of taking effective action. In view of the cost of adequate air pollution control programs this lowest level of government may be a region or district composed of several political jurisdictions or it may be individual counties, cities, towns, or boroughs. Care must be taken, however, to insure a sufficiently broad population, economic, and area base to provide for effective action.

For the purposes of this discussion agencies of regions or districts are considered to be local where they are responsible to the elected officials of jurisdictions comprising the region or district. Where such agencies are the geographically decentralized units of a state program, they are discussed under the responsibilities of state agencies.

Local health agencies have normally been charged with promoting the com-

munity's health. Air pollution is recognized as an environmental factor which can affect the people's social, physical, and mental well-being. As such, even in the absence of specific legislation, it is the inherent responsibility of such local health agencies to ascertain the degree of need for air pollution control programs. It is furthermore their responsibility to take necessary action under existing general legislation until such time as a specific delegation of authority has been made.

Where strong environmental health programs exist in the local health agency considerable efficiency can be obtained by the utilization of existing personnel, laboratory facilities, and administrative technics, since many activities will already be in contact with potential sources of air pollution through work on the disposal of refuse and sewage, investigation of occupational health problems, and concern over the processing and preparation of food. This prior involvement with industrial, commercial, and governmental establishments will often make simultaneous investigations of several environmental factors feasible.

As a result of its studies and experience the health agency should advise the local law-making body on appropriate legislation for the control of both direct air pollution problems in which specific sources create a recognized problem for the recipients of the pollution, and the indirect air pollution problems which result from general area contamination from a multitude of sources. Such legislation should clearly avoid the dangers of split responsibility. To this end the authority for control of problems normally considered to be nuisances should not be separated from the authority for the control of problems believed to have public health significance.

If in spite of the many advantages of coordinating air pollution control with other activities of local health agencies, the community structure is such that the administrative responsibility can best be placed in an independent or other agency, the local health agency should offer consultation, support, and active cooperation to the designated authority. This is of particular importance in establishing standards for air quality relating to the public's health.

The agency authorized to control air pollution must establish programs capable of obtaining and maintaining a community air supply which will primarily promote the maximum development of personal health and foster the economic and social growth of the community. Typical of the necessary responsibilities and activities are the following:

(a) The determination of the present quality of the community's air supply and estimation of its potential change with projected community growth. This study necessitates air monitoring for specific contaminants and parameters defining rates of natural ventilation.

(b) The evaluation of present and potential air quality with respect to its health and socioeconomic effects.

(c) The delineation of program criteria and the implementing rules and regulations, including emergency procedures for acute episodes.

(d) The planning in coordination with other agencies, to cope with air pollution accidents and disaster.

(e) The investigation of existing problems through self-initiated and complaint-initiated inspections and studies. Where possible these studies should include the sampling of specific sources of air pollution, such as stack effluents.

(f) The obtaining of the necessary degree of abatement through persuasion where possible, and by legal action where indicated.

(g) The prevention of air pollution by review of plans, establishment of equipment standards, and preventive maintenance inspections of potential sources.

(h) The prevention of air pollution through cooperative efforts with governmental and community organizations exercising control over zoning and community planning.

(i) The prevention of air pollution through coordination with agencies responsible for

the inspection of industrial, commercial, and residential properties for factors which may have an incidental effect on air pollution.

(j) The provision of appropriate education and information to industry by consultative services to engineers and management, by the instruction of plant operating personnel in procedures which will minimize air pollution.

(k) The maintaining of an active program for the dissemination of information to the public concerning factual information on the origin and control of air pollution.

One of the most fundamental responsibilities of the local agency is to serve as a source of information on the generation and control of air pollution in the area. The community must be kept informed on the need for control and the time and moneys necessary to accomplish the desired control at individual sources and for the community as a whole. An informed community will accept a reasonable rate of accomplishment. On the other hand, lack of guidance and information may result in community hysteria and the attendant establishment of unreasonable standards and rates of accomplishments. Existing chambers of commerce, industry cooperative groups, and civic organizations can assist in providing the necessary community support for effective programing.

As pointed out previously there is a real need for active cooperation between other government agencies and the agency authorized to control air pollution. Health agencies can provide valuable assistance through guidance on standards and studies of air pollution relating to the public health. All agencies having an inspectional function relating to potential or actual sources of air pollution should assist in the referral of appropriate information to the authorized agency and in joint investigations where indicated. Agencies providing a plan review function should recognize the need for referral of appropriate items for review with respect to the control of air pollution. Zoning and planning agencies should similarly recognize that failure to include air pollution considerations in their activities will lead to the promotion of otherwise preventable air pollution problems.

The local government as a whole must recognize its responsibility to provide adequate financing of the air pollution control program where the need for such programing and the appropriate legal base has been established. Such financing may readily be in the range of from 10 to 20 cents per capita, or more, where unusual problems exist. Furthermore, the local government must recognize the need for and accomplish the abating of governmental sources of air pollution, such as open burning dumps, improper incineration of refuse, and smoke from public buildings.

Industry and the Public

Generally, in air pollution control we are concerned with polluting products from the activities of man as he participates in industrial operations and as he lives as an individual among the many comprising the public. Industrial activity has become an important element of the socioeconomic vitality of any area. Man's habits in heating and cooling his home, in disposing of refuse, and in transportation are part of our civilization.

In seeking a solution to air pollution problems, industrial productivity and social freedom must be safeguarded. Obviously, air pollution which creates a health hazard must be eliminated. Other problems with deleterious effects should be controlled to a level consistent with the over-all interests of the community. It should be recognized that the air may properly be used as a means of disposing of useless residues to the extent compatible with public health, welfare, and comfort. While the responsibility of government is recognized, the development of a

reasonable and effective approach to air pollution control requires the understanding, support, cooperation, and participation of industry and the public.

Industry's Role

Industry's role in air pollution control is fourfold:

1. Industry should measure and evaluate its emissions which contribute to the overall community pollution levels or to specific problem situations.
2. Where air pollution problems exist, industry must provide the necessary measures for eliminating or reducing them to acceptable levels.
3. In some instances, industry must engage in or sponsor research.
4. Industry must participate in and support all facets of community air pollution control programs.

Reduction of pollutant concentrations or pollution abatement implies correction of conditions that already exist. Enlightened management today accepts responsibility for evaluating potential air pollution problems before beginning new construction. Initial construction plans should include equipment fully adequate to collect and dispose of potential pollutants to the extent required to prevent air pollution.

Any investigation of pollution levels in a community, prior to plant construction or from existing operations, eventually must consider emissions from specific sources. Before control measures and abatement equipment can be developed, the nature and degree of the problem must be known. In industrial operations, the qualitative and quantitative determination of pollutants from vent stacks, unenclosed processes, disposal areas for unwanted by-products and sewers involves such a detailed study of operations that plant personnel should be better qualified to make the studies because of familiarity with the operations.

Second, if the industry's or plant's scientists and engineers or retained qualified consultants assume this responsibility, maximum industrial security is realized. In many instances, the operations and processes study will show obvious means for the elimination or reduction of pollutants prior to the point where discharge to the atmosphere is considered at all. Control at this point, then, need not be of any major concern to public air pollution control agencies.

As more management representatives accept this responsibility before community activity forces acceptance, community air pollution problems will not develop. Further, since many (except for few notable exceptions) air pollution conditions still involve nuisance levels rather than well documented deleterious effects on health, it appears logical that reduction or elimination of nuisances may also eliminate concern over social, economic, and health aspects.

Where unlimited pollutant discharge has overburdened the atmosphere in terms of its ability to receive, disperse, and dispose of pollutants, industry must provide measures for reducing pollution to acceptable levels. As in determining the nature and amount of its emissions, industry generally is best qualified to develop the means for eliminating its problems, particularly where abatement and control measures and equipment are known and acceptable.

The value of collected pollutants rarely justifies the cost of installing abatement equipment. The willingness of industry to share in community welfare then becomes the justification. It is at this point, however, that it may be necessary to reach a mutual agreement with the public and its air pollution control agencies on the degree to which some emissions may logically be controlled. There may be situations where the total community interest will dictate an acceptance of minimal levels of pollution, where effects are of a minor esthetic nature only, until eco-

nomically feasible methods of control are developed. This is not to imply that the industry involved can or will cease to look for economic means of controlling emissions; it does imply that additional time and research may be required.

The best designed control equipment will not eliminate pollution if management does not provide for its correct operation and maintenance. Air treatment equipment must be operated as an integral part of the process, and supervisory and operating personnel must be convinced that management has as direct and sincere an interest in air pollution abatement as it has in production rates and the health and safety of its employees. If air cleaning equipment is needed the process should not be operated without it in use.

In general, industry has accepted its responsibility to sponsor research in certain areas of pollution control problems. Where the emission is peculiar to a single process or operation in one or a few plants, it is logical that research costs for pollution abatement should be underwritten by those responsible for the problem. Similarly, where the problem is related to operations throughout an industry, it is logical that each corporation should accept its share of research conducted on a cooperative basis either through informal arrangements or, perhaps, more formally through trade associations or institutes. Considerable credit is due specific industries for efforts already involved in air pollution abatement, as evidenced by results documented in technical and trade association journals and in the public press. The contributions of individual companies in research efforts have not been as widely publicized; nevertheless, notable results have been attained.

Again, in specific industries, industry personnel may be best qualified to engage in research because of their familiarity with the complexities introduced by individual operations or processes.

Industry must participate in over-all community programs to reduce pollution in areas where such programs exist, beginning with a forthright community relations program. To demonstrate good faith industry cannot attack the engineering phases of pollution abatement and keep the record of its accomplishments confidential. Industry must tell its employees, its neighbors, and the community at large of the problems, what is being done about them, and what can and will be accomplished. The usual means of presenting industry's story, including internal company publications, plant visits for employees' families, neighbors, community leaders, and representatives of the local press, have all been found to be effective. While management must be conservative in seeking publicity, it must realize that the public has a right to certain information through the median of the press, radio and television, and it is to the company's advantage to see that factual information is made available promptly, accurately, and completely.

When air pollution problems have developed to the point that the public, civic leaders, and government agency representatives are seeking legislation to authorize air pollution control programs, management must accept some responsibility for participating in the development of realistic legislation. This participation may be through representatives of individual companies or as members of committees of industry groups, local Chambers of Commerce, or other civic organizations.

Finally, industry must demonstrate its good faith by cooperating fully and sincerely with air pollution control agencies whether or not such agencies have enforcement and/or regulatory powers. In a problem area noted for its technicological, economic, physio-

logical and psychological complexities, little progress can be made if obstinate, unrealistic, and defiant attitudes are adopted by any of the parties working toward solutions to the problem. Industry should and will accept the responsibility for putting its own house in order and will accept assistance from all technically competent and objective representatives of official agencies.

Assistance from official and other agencies is particularly important to moderate and small size plants which, in number, represent the largest segment of American industry. Only the larger corporations can justify economically the costs for a staff of engineers competently trained and experienced in air pollution control. Where such individuals are not available within a company, management must call on independent consultants, services of universities and research institutes, and, to a degree, insurance carriers and trade associations.

Role of the Public

The public, in the final analysis, is responsible for air pollution and for its control. Pollution, we say, is the result of the activities of man. Control, as we know it, is only achieved through the organized efforts of man. The weight of public opinion and of public funds is essential to the success of air pollution control at all political levels.

For purposes of this discussion "the public" will be defined to exclude personnel in federal, state, and local health, investigative and enforcement agencies, and those in industry, since these segments of the general public are covered in the preceding discussions. We are dealing, then, with the ordinary citizen and organizations of his own creation.

Public awareness of air pollution generally begins with recognition of nuisances and health hazards, without an understanding by the individual that his own actions, or sanction of actions by others, may be the cause. The role of the public, therefore, has been to seek control after the fact rather than before. Our system of establishing standards for toleration by human beings has, until very recently, been based on this procedure.

The role of the public should begin with an understanding that air is a limited resource, and its pollution is of concern to everyone. Education (from an early age is essential for this understanding) and air pollution information properly belong in the "conservation" programs in our schools.

To this end, information must first be communicated to school authorities, members of boards of education, and community leaders in Parent-Teachers Associations and other citizen groups. A typical chain of communication might begin with letters, be followed by personal talks or audiovisual material, and culminate in textbook treatment.

Adult education to the same end can be encouraged through many media: newspapers, radio, TV, audiovisual aids, and in talks and distribution of literature to civic groups, and so forth. The regulatory agencies here must play an essential role in seeing that reporters and other communicators are fully informed by their own personnel and by other qualified authorities. The experience of Los Angeles in both school and adult education should be helpful to other cities in setting up a list of the most effective tools and media.

Air pollution education should stress the relation of the individual to his environment—the manner in which each person, in a community made up of millions, can pollute the air for himself as well as for others with trash burning, with poorly functioning heating apparatus, with the automobile.

The role of the public in control is

to sanction, through its elected representatives, research, regulation, and enforcement at different political levels. The process begins at the neighborhood level with a citizen or groups of citizens recognizing an existing or potentially annoying or injurious condition. The problem is discussed with those in authority, and when it becomes widely known throughout a political autonomy, legislation follows, with public funds appropriated to make it effective. In many instances local authority has first to be won from the state; and in the matter of research, at least, states now turn to federal authorities and funds.

The control process is seldom achieved without leadership—by able, vocal citizens, by politicians, and almost invariably by those who are prominent in the communications fields. Government, through the mechanism of advisory groups drawn from many segments of the public, can and does make good use of leaders. The leaders, however, cannot function without public support. For instance, if leaders and regulatory agencies believe controls are necessary which go beyond the public's tolerance of existing conditions, factual material to support their position must be disseminated and widely discussed. Tolerance, as air pollution is corrected, often may change and stricter controls follow.

Information is as essential in the public's role in control of air pollution as in comprehending the creation of pollution problems. A poorly informed public may neglect the correction of a potentially hazardous condition, or it may demand unreasonable controls. The public's eyes and noses become quickly aware of smoke, ash, soot, and strong odors in the atmosphere. However, less obvious vapors and particles of matter, such as the radiation hazard, must be identified for the public, and their effects on health, under local meteorological conditions, explained. This is the role of the health agencies, working with communications media. Yet nowhere, excepting perhaps Los Angeles, are the total emissions or their dispersal or concentration through meteorology, understood. Lacking this information in the hands of the scientists, and its interpretation by communicators, the public cannot fulfill its role in air pollution control. It will do so when it is informed.

Air Pollution Control Policy

In summary, the Air Hygiene Committee recommends the following declaration of policy:

1. Excessive air pollution is a public health problem. As a health problem, the control of air pollution is a responsibility of government. Because air pollution is increasing in magnitude and because of the mounting health significance, the resources of all levels of government are required to protect the public.

2. Health agencies have historically been charged to evaluate environmental factors as they relate to the health of man and to curb or modify those conditions detrimental to normal life and health. Staffs of administrators, epidemiologists, engineers, chemists and other personnel, laboratories and other facilities used in other environmental health activities are equally adaptable to coping with the problems of the air environment. Accordingly, while special local considerations may dictate otherwise, it is logical that responsibility for air pollution control activities be administered by public health agencies at the federal, state, and local levels. Public health administrators must be ready to accept responsibility for a unified air pollution control program, including health, social, and economic aspects, and must prepare their organizations to adequately fulfill this duty.

3. Coordination of governmental effort through an understanding of relative responsibilities is essential.

a. The Public Health Service should provide vigorous leadership in the national effort. It should initiate broad investigations and research to define the problems of air pollution, their effects upon health, and feasible methods of control. The Public Health Service also has the duty to encourage the training of personnel, to disseminate information, and provide consultation to state and local agencies.

b. The state health department is responsible for the over-all investigation and interpretation of the air pollution problem in the state. It should also provide planning at state level, and when needed, foster the development of effective programs at lower levels of government through consultation, information, and technical assistance. Normally enforcement should be at local levels, but for special situations, like moving sources (auto exhausts), direct state action may be required.

c. Local health agencies should assess the air pollution problems of the area served and establish criteria for the control of specific sources of pollution. This requires monitoring the air, sampling stack discharges, and surveying operations and activities of industry and the public. Enforcement of laws and regulations is a local responsibility. Prevention of air pollution should be encouraged through review of plans, instruction to operating personnel, and public information activities.

4. Industry and the public must recognize that pollution problems are created by their activities and they should assume their own responsibility for curbing polluting emissions. Furthermore, industry and the public must support the community efforts through government for the air pollution control programs to be truly effective.

5. The primary objective of an air pollution control program should be to protect and preserve public health and the economic and social welfare of a community. Nuisances which impair the comfort and repose of citizens and the comfortable enjoyment of property should be curbed. The application of controls to nuisance conditions should be reasonable with respect to time, technology, and economics so as not to destroy the vitality of the industrial community or unduly interfere with individual freedom.

P. W. PURDOM, P.E., Director, Division of Air Pollution Control and Environmental Sanitation, City Department of Public Health, Philadelphia, Pa., Chairman
LESLIE A. CHAMBERS, Ph.D.
L. ARNOLD NICHOLSON
RALPH C. PICKARD, M.P.H.
ALEXANDER RIHM, JR., P.E.
FRANK M. STEAD, P.E.
ARTHUR C. STERN
RAYMOND SMITH, M.P.H.
ELMER P. WHEELER

REFERENCE

1. Dixon, James P. What Does Air Pollution Do To Humans? Proc. National Conference on Air Pollution, 1959. Washington, D. C.: Gov. Ptg. Office.

ASSOCIATION NEWS

APHA ANNUAL MEETINGS

1960—October 31-November 4—San Francisco, Calif.
1961—November 13-November 17—Detroit, Mich.

Open Meeting on Resolutions

The Committee on Resolutions invites all members of the APHA in attendance at the Annual Meeting to the public reading of all policy resolutions which were submitted to it before August 31, the 1960 deadline date. (No resolutions dealing with policy are accepted later than 60 days before the first Governing Council meeting at the Annual Meeting.) The reading will take place on Monday, October 31, 1:30 p.m., in the Comstock Room, Sheraton-Palace Hotel. The Committee on Resolutions presents its report to the Governing Council on November 2.

Open Meetings of Governing Council

APHA members who will be in attendance at the Annual Meeting in San Francisco are welcome to and urged to attend the meetings of the Governing Council, the APHA policy-making body. The Governing Council meets Sunday, October 30, at 2:00 p.m., in the Concert Room, and Wednesday, November 2, at 2:15 p.m., in the Rose Room, Sheraton-Palace Hotel.

The APHA Member as a News Reporter

A midwestern village recently began reviewing all of its ordinances pertaining to health, and one of the members of the Board of Health wrote in to "1790," asking for copies of "model" ordinances. The only help to be given in response was, it turned out, limited. This prompted anew the question, "Is APHA headquarters receiving material from members that reports on their latest activities or contributions in the development of health laws, codes, and regulations?" The natural next step was to question whether or not members have the Association's office on their mailing list for other kinds of important materials like new program manuals and special study reports. "1790" gets much of this. Does it get the full measure it could and should?

That these questions are meaningful was also pointed up during a recent visit to a health agency by an APHA staff member. There he was shown a document which described a program that has a truly new approach in the administration of mental health services. The write-up was excellent, the agency was justly proud of the program, copies of the report were available, and yet, unfortunately, it had not been publicized to the profession as a whole. Staff at "1790" could have done this not only by citing it in the news sections of the Journal but also by passing along the good news through correspondence and by word of mouth.

That story has a happy ending. The program will be the subject of an article in a professional journal and news of it will be disseminated to many public health workers who will benefit from the knowledge.

But what about the endings of other stories? How many other members and agencies with similar written de-

scriptions of programs, experiments, studies, results of conferences, etc., are hiding their lights under bushels? Echoing scripture, might not the entire membership urge their colleagues to let their light so shine before men that they may see their good works? The staff can assist in making important new data visible, and in turn will itself be kept up to date on new developments.

Perhaps a request that would help make APHA via "1790" an increasingly effective communications center for the profession might be put this way. First, would each member consider himself a self-constituted news gatherer whenever he comes upon an interesting piece of information embodying an important idea or program. (It need not be in print either.) Second, would he then ask himself the question, "Might other colleagues in the profession, wherever they live and work, be grateful to share in this information?" If the answer to that is "yes," would he then please pass the word along to APHA Headquarters?*

This takes time out of a busy day, granted; but the fact that professional people do take such time has always been one of the distinguishing marks of a profession.

* An example of a report from a group which considered itself a "self-constituted news-gatherer" is found in the News from the Field section in this issue: "Do-It-Yourself: Operation Reality."

The Moment of Truth: Cancer

"With present knowledge, we cannot promise to make cancer as rare as typhoid or smallpox, but much progress can be made, and at a much faster pace.

"Our present position reminds me a little of one of the high points of the recent Winter Olympics. Perhaps you were impressed, as I was, with the "moment of truth" which the ski jumper experiences as he commits himself at the top of the run. Once out of the pit, there is no turning back. He will either jump or fall off in disgrace; show good form, or lose points; stretch for distance, or rank low; land properly, or break a leg. All of these things he knows as he bounds out and begins to speed down the run. We have reached a somewhat similar "moment of truth" in the effort against cancer . . . with the opening of new concepts in etiology . . . the acute awareness that more than clinical office practice is needed to find the disease early and care for it properly . . . and the growing commitment of the community in the attack. Much the same as the ski jumper, we now must spring forward, with form based upon past experience, striving for new distance, a happy landing, and a better score in our match with this great plague of our times."

(Albert E. Heustis, M.D., M.P.H., commissioner, Michigan Department of Health from "Cancer and the Community" in Michigan's Health, May, 1960.)

NEWS OF AFFILIATED SOCIETIES AND BRANCHES

APHA Affiliated Societies and Branches

Society and Secretary

ALABAMA PUBLIC HEALTH ASSOCIATION, Ralph Roberts, State Health Dept., Montgomery
ARIZONA PUBLIC HEALTH ASSOCIATION, Joseph J. Weinstein, Maricopa County Health Dept., Phoenix
ARKANSAS PUBLIC HEALTH ASSOCIATION, Mrs. Vada Russell, State Health Dept. Bldg., Little Rock
CALIFORNIA, NORTHERN PUBLIC HEALTH ASSOCIATION, Mrs. Joan Davis, City Health Dept., San Jose
CALIFORNIA, SOUTHERN, PUBLIC HEALTH ASSOCIATION, Dorothea Hansen, City Health Dept., Los Angeles 12
COLORADO PUBLIC HEALTH ASSOCIATION, Alice de Bruyn Kops, 4660 S. Delaware, Englewood
CONNECTICUT PUBLIC HEALTH ASSOCIATION, Shirley Thayer, R.N., 61 Arnold Way, West Hartford 7
CUBAN PUBLIC HEALTH SOCIETY, Dr. Raphael Calvo Fonseca, Calle 19 No. 311 Altos Vedado, Havana
FLORIDA PUBLIC HEALTH ASSOCIATION, Everett H. Williams, Jr., P. O. Box 210, Jacksonville
GEORGIA PUBLIC HEALTH ASSOCIATION, Mrs. Martha Power, State Health Dept., Atlanta 3
HAWAII PUBLIC HEALTH ASSOCIATION, Alison MacBride, R.N., 510 S. Beretania St., Honolulu 13
IDAHO PUBLIC HEALTH ASSOCIATION, Ralph Carpenter, 129 N. Capitol Blvd., Boise
ILLINOIS PUBLIC HEALTH ASSOCIATION, William J. Hixon, Evanston Health Dept., Evanston
INDIANA PUBLIC HEALTH ASSOCIATION, Malcolm J. McLelland, State Board of Health, Indianapolis
IOWA PUBLIC HEALTH ASSOCIATION, Lloyd Coe, Iowa Hospital Association, 1012 Liberty Bldg., Des Moines
KANSAS PUBLIC HEALTH ASSOCIATION, W. W. Wilmore, Kansas Tuberculosis and Health Assn., 1134 Topeka Ave., Topeka
KENTUCKY PUBLIC HEALTH ASSOCIATION, Miss Peggy Fisher, 275 E. Main St., Frankfort
LOUISIANA PUBLIC HEALTH ASSOCIATION, A. G. Owens, P. O. Box 1672, Monroe
MARYLAND PUBLIC HEALTH ASSOCIATION, Mary Thompson, Prince Georges County Board of Education, Upper Marlboro
MASSACHUSETTS PUBLIC HEALTH ASSOCIATION, Mrs. Elizabeth K. Cano, Dept. of Health, Cambridge
MICHIGAN PUBLIC HEALTH ASSOCIATION, Howard Hilton, Washtenaw County Health Dept., County Bldg., Ann Arbor
MINNESOTA PUBLIC HEALTH ASSOCIATION, D. S. Fleming, M.D., State Dept. of Health, University Campus, Minneapolis
MISSISSIPPI PUBLIC HEALTH ASSOCIATION, H. E. Boone, P. O. Box 1700, Jackson
MISSOURI PUBLIC HEALTH ASSOCIATION, Mrs. Nadia Craver, 5th Fl., State Office Bldg., Jefferson City
MONTANA PUBLIC HEALTH ASSOCIATION, Thomas S. Willett, Montana Public Health District 1, Hardin
NEBRASKA PUBLIC HEALTH ASSOCIATION, George R. Underwood, M.D., 935 R. St., Lincoln
NEW JERSEY PUBLIC HEALTH ASSOCIATION, Waldo McNutt, M.P.H., Delaware River Drive, Frenchtown
NEW MEXICO PUBLIC HEALTH ASSOCIATION, Daniel T. Marley, P. O. Box 8066, Albuquerque
NEW YORK CITY, PUBLIC HEALTH ASSOCIATION OF, Frances Ann McVey, 4317 Robinson St., Flushing 55, N. Y.
NEW YORK STATE PUBLIC HEALTH ASSOCIATION, Carline Millican, Rochester Regional Office, State Health Dept., Rochester
NORTH CAROLINA PUBLIC HEALTH ASSOCIATION, Robert W. Brown, Box 7525, Asheville
NORTH DAKOTA PUBLIC HEALTH ASSOCIATION, Alice H. Peterson, M.D., State Dept. of Health, Bismarck
OHIO PUBLIC HEALTH ASSOCIATION, Mrs. June O'Donnell, 3316 Braddock St., Dayton
OKLAHOMA PUBLIC HEALTH ASSOCIATION, Bill Burk, 3400 North Eastern, Oklahoma City
OREGON PUBLIC HEALTH ASSOCIATION, Muriel David, City Bureau of Health, 203 N.E. 28th Ave., Portland
PENNSYLVANIA PUBLIC HEALTH ASSOCIATION, Emma J. Petach, R.N., 324 N. Second St., Harrisburg
PUERTO RICO PUBLIC HEALTH ASSOCIATION, Mrs. Mae de Acin, Apartado 211, San Juan 2
SOUTH CAROLINA PUBLIC HEALTH ASSOCIATION, Emily Anne Easterling, Richmond County Health Dept., Columbia
SOUTH DAKOTA PUBLIC HEALTH ASSOCIATION, Alice Brady, R.N., State Dept. of Health, Pierre
TENNESSEE PUBLIC HEALTH ASSOCIATION, C. B. Tucker, M.D., State Dept. of Health, 420 Sixth Ave., N., Nashville
TEXAS PUBLIC HEALTH ASSOCIATION, Joseph N. Murphy, Jr., State Dept. of Health, Austin
UTAH PUBLIC HEALTH ASSOCIATION, Katherine Brandon, M.D., P. O. Box 25, Foothill Station, Salt Lake City
VIRGINIA PUBLIC HEALTH ASSOCIATION, Robert M. Parker, 401 Colley Ave., Norfolk 7
WASHINGTON STATE PUBLIC HEALTH ASSOCIATION, Caesar Branchini, Benton-Franklin County Health Dept., Pasco
WEST VIRGINIA PUBLIC HEALTH ASSOCIATION, Mrs. Katherine L. Brown, State Dept. of Health, Charleston 5
WISCONSIN ASSOCIATION FOR PUBLIC HEALTH, Paul Weis, RR No. 2, Waunakee
MIDDLE STATES BRANCH, APHA, Thelma Luther, Dept. of Health, Des Moines, Iowa
SOUTHERN BRANCH, APHA, M. L. McDonald, Dallas Health Museum, Dallas, Tex.
WESTERN BRANCH, APHA, Robert G. Beaumier, 1309 Smith Tower, Seattle, Wash.

Empire Staters Gather for the 56th

Fifteen organizations and groups took part in the 56th Annual Health Conference of New York State, held this year in New York City, May 23-26. Including 137 guests, over 2,000 persons registered. A major share of the scientific sessions was provided by the nine sections of the New York State Public Health Association (NYSPHA).

Norman S. Moore, M.D., Ithaca, president, Medical Society of the State of New York, opened the first general session with an address on "The Physician and Modern Public Health Problems." One of the problems is centered on "the need for arousing public opinion to reject processes currently working against public health . . . (for example) the public at present allows its better sense to be swayed by cultists and fanatics on the issue of fluoridation."

State Health Commissioner Herman E. Hilleboe, M.D., spoke next on "Public Health, 1960." "The modern man is ready to find out something," he said. "He is ready to learn that his desire for good health coupled with his unhealthful way of life is an enormously expensive combination. This man can be shown that the cost of his bad health habits is directly measurable in the amount of his income, his health insurance premiums and his monthly bill at the corner drug store. He has yet to realize, the typical American, that the high cost of medical care is linked up very closely with the number of times he gets sick. He has forgotten that his own habits and attitudes affect the number of times he gets sick, how sick he gets and how quickly and completely he recovers. This is where public health workers come in, or ought to come in. Those of us in public health have a powerful answer to the high cost of medical care; we have always had it and it is high time we began telling people about it more often. . . . It is preventive medicine. . . . We need a rebirth of the evangelical spirit of public health."

Governor Rockefeller closed this general session with a progress report on the state's quest for better health, pointing to increasingly effective efforts in the care of the chronically ill and mentally disabled, in the distribution of medical resources, in the provisions of medical care payment mechanisms, in rehabilitation programs, and in environmental health services.

The second general session was devoted to "Some Emerging Problems in Public Health." Robert J. Huebner, M.D., chief, Laboratory of Infectious Diseases, National Institute of Allergy and Infectious Diseases, Washington, D. C., spoke on the growing importance of virology. Richard H. Chamberlain, M.D., professor of radiology, University of Pennsylvania, Philadelphia, described some of the effects on health of ionizing radiation, and Leslie Chambers, Ph.D., scientific director, Allan Hancock Foundation for Scientific Research, University of Southern California, discussed the changing character of the air pollution problem. In his summary remarks, Dr. Chambers suspects "that the most obvious change affecting the problems of air quality regulation is occurring now and will continue to develop momentum for the next decades. Awareness on the part of scientists and public health officials of the nature of the problems is increasing at a gratifying pace, and the growth of public concern is perceptible beyond acutely affected areas. We are more able to put into public communication lines some substantive answers."

Among sectional programs was a joint session sponsored by the Medical Section, NYSPHA, the Public Health Association of New York City (PHANYC), and the New York Region Medical Care Section, APHA. At this, Paul A. Bunn, M.D., professor of medicine, State University of New York, Upstate Medical Center, Syracuse, spoke on the "Use and Abuse of Antibiotics." Ray E. Trussell, M.D., M.P.H., chairman, School of Public Health and Administrative Medicine, Columbia University, described some of the findings of the school's study of prepayment of hospital care in New York State. He pointed out in his introduction that the extent of coverage has a direct bearing on the public health burden in such fields as mental health and rehabilitation. More public health workers, he also noted, are being asked to serve on Blue Cross boards.

A listing of but a few titles of papers given at the meetings of another NYSPHA section—Behavioral Sciences—will convey some of the unusualness of flavor of the scientific program: "How Health Officials Compare with Other Local Officials in Assessing County

Needs" (Roland L. Warren, Ph.D., State Charities Aid Association, New York City); "Role Dominance and Patterns of Medical Care" (Sylvia B. Gilliam, Ph.D., New York City Department of Health); and "The Social Class of Patients Public Health Nurses Prefer to Serve" (Charles V. Willie, Ph.D., State University of New York Upstate Medical Center, Syracuse).

At its scientific sessions PHANYC heard about some current health demonstration projects in the city. Among the speakers were George James, M.D., first deputy commissioner of the City Health Department, who described the Corona rehabilitation project, and Bernard Kutner, Ph.D., professor at Albert Einstein College of Medicine, Yeshiva University, who gave the results of his study on delay in diagnosis and treatment of cancer.

Morton D. Schweitzer, Ph.D., assistant professor of epidemiology, Columbia University School of Public Health and Administrative Medicine, is 1960-1961 president of PHANYC. George James, M.D., was named president-elect; Francis Ann McVey, supervisor, Out-Patient Department, New York Hospital, is secretary-treasurer. Morey R. Fields, Ed.D., M.P.H., chairman, Department of Physical Education, Health, and Welfare, New York University, was elected to the board for a two-year term.

NYSPHA's Annual Hermann M. Biggs Memorial Award for outstanding work in public health was presented to Morton L. Levin, M.D., life-time professor of research, Roswell Park Memorial Institute, Buffalo, formerly assistant commissioner for medical services with the State Health Department. The State Medical Society's Empire State Award for Excellence in Medical Reporting, given for the first time in 1960, went to Miss Cathy Covert, science writer for the Syracuse Herald-Journal and Herald-American.

NYSPHA's 1959-1960 president, Walter C. Levy, M.D., assistant director, Division of Local Health Services, State Health Department, reported on association activities during the past year at the annual conference luncheon. These included the revision of "Guide for the Organization and Promotion of Regional Health Conferences" and the preparation of "Guide for the Establishment of Sections," which was adopted by the executive committee. He also reported that the number of APHA affiliated members of NYSPHA increased from 706 to 714, and that the number of other individual members grew from 406 to 427.

V. J. Sallak, executive director, Buffalo and Erie County Public Health and Tuberculosis Association, succeeded Dr. Levy as president. Other officers for 1960-1961 are:

President-Elect—Marion L. Henry, assistant commissioner for administration and management, State Health Department, Albany

First Vice-President—Rita Chisholm, assistant professor of public health nursing, Nazareth College, Rochester

Second Vice-President—William A. Brumfield, Jr., M.D., commissioner, Westchester County Department of Health, White Plains

Secretary—Carline Millican, nutritionist, Rochester Regional Office, State Health Department

Treasurer—Eugene J. Cahalan, administrative officer, Division of Laboratories and Research, State Health Department, Albany

Northern California Winds Up Year

Over 1,000 public health workers, voluntary agency executives, elected officials, and interested citizens converged on the Castlewood Country Club in Pleasanton to attend the Northern California Public Health Association's Annual Meeting, May 5. This brought to a close the association's program year which featured four meetings with an aggregate attendance of some 2,500 persons.

The 600 members of NCPHA in attendance elected officers; adopted reso-

lutions, which accepted by-laws for the association and reaffirmed NCPHA's earlier endorsement of fluoridation; and amended the constitution to allow the Governing Council to grant honorary memberships to retiring members.

Proving once again that the members do take an interest in the administration of their association they turned down, by a two to one margin, a proposed resolution to extend the newly elected officers' terms an additional six months and to change the date of the annual meeting from May to December. The purpose of the resolution was to bring the officer, fiscal and program years into conformity with one another and to put them on a calendar year basis.

The question arises whether the action of the membership was a vote against extending the next officer year to 18 months or whether it expressed a desire for a spring annual meeting. This question of conformity of years will be one of the first problems the incoming Governing Council will have to face.

Unanimously elected to at least a one-year term of office were: Mrs. Dalrie Lichtenstiger, executive director, California Tuberculosis and Health Association, president; Alvin Leonard, M.D., health officer, Berkeley City Health Department, president-elect; Ernest Bertellotti, director of health education, Santa Clara County Health Department, vice-president; Seiko Baba, laboratory director, Alameda County Health Department, treasurer; and Joan Davis, supervising public health nurse, San Jose City Health Department, secretary.

As has been the pattern for the last several years the program was planned around meetings of the association's various sections. The Medical Section tackled two topics of high current interest—the streptococcal problem and medical care. Public health nurses heard a panel discuss the impact of society's changing needs and new research findings on their profession. The Sanitation Section's program ranged from well-drilling to concepts of public service administration. Health educators looked at some of the barriers to accepting public health programs. The Statistical Section turned its interest to alcoholism and the State Health Department's Human Population Laboratory project. Other highlights of the section meetings were the VD investigators' discussion of homosexuality as it relates to venereal disease; the problem of aging and its implications for social workers; and presentations on the use of fluorescence microscopy in disease diagnosis and methods in the detection of air pollution by laboratory personnel.

William McDougall, general counsel for the County Supervisors Association of California, in his keynote address outlined four problems local government will face during the next session of the legislature. They are: the tuberculosis subsidy in relation to changing treatment technics and hospitalization practices; financing of community mental health services; the state alcoholic rehabilitation program's relationship to other mental health services; and putting the public health subsidy on a more realistic fiscal base.

Eric Reynolds, M.D., immediate past president of the California Medical Association, pointed out at the luncheon session that education for leisure and nonvocational rehabilitation were more pressing problems than hospitalization and surgery for California's aging population.

Outgoing president James C. Malcolm, M.D., heart officer for Alameda County reviewed the year's principal accomplishments: increased membership, closer relationship with the Southern California Public Health Association, establishment of a newsletter, and a revamping of the association's policies and procedures.

Administrators of California Crippled Children Services and the California

Association of Sanitarians, Northern Chapter, held their annual meetings in conjunction with NCPHA.

(EDITORS NOTE: The Journal is indebted to Nick Parlette, editor, NCPHA News, for this report of the meeting.)

Louisiana Takes A Timely New Look

The Louisiana Public Health Association met May 19-20 in New Orleans. The general theme of the conference is seen from the titles of three major papers presented at the first general session: "The Nurse's Role in the Challenge of Communicable Disease Today," by Mary R. Lester, chief, Nursing Section, Communicable Disease Center, Atlanta; "The Role of the Sanitarian in Communicable Disease Control," by Reuel H. Waldrop, technical consultant, Public Health Service, CDC, Oklahoma City; and "Current Major Problems in Tuberculosis Control," by Margaret H. D. Smith, M.D., associate professor, Department of Pediatrics, Tulane University School of Medicine, New Orleans.

Andrew Hedmeg, M.D., LPHA president and director, Local Health Services, Louisiana State Board of Health, opened the meeting and characterized its focus as "Timely (in) that a thorough reevaluation of our public health approach to the control of some of the older communicable diseases such as smallpox, typhoid fever, diphtheria, and so on, is needed."

Mrs. Lester noted that while there has been a consistent decline in the incidence of some contagious diseases, new entities are being identified as communicable, and certain of the long-recognized ones remain as major public health problems. Those of importance in this country today, she said, are diseases controlled to such an extent that only active surveillance is necessary; those for which effective procedures for prevention and control are known, but not sufficiently applied; and diseases for which effective preventive measures are unknown.

At the second general session, Sim B. Shattuck, program officer, Division of Health Mobilization, PHS, Washington, D. C., spoke of the division's program. "Civil defense health services in anticipation of a thermo-nuclear attack are practically in their infancy," he said. "There are many unknowns in the areas of supplies, manpower utilization, training and education, public information, and many other phases." The Public Health Service feels that "a program of training and education is basic in the mobilization of health resources for emergency."

At the business meeting, Dr. Hedmeg, in his Presidential Address, cited some of the LPHA's accomplishments during the past year. These include the establishment of a budget, a five-year study of the financial structure of the association, completion of a "Manual of Procedure" for officers and convention planning, and new methods of promoting attendance at the annual convention.

A reorganization plan was proposed at the business meeting for the purpose of improving community relations and of encouraging community backing of the state's public health program. It was proposed that representatives from 15 state organizations be invited to serve as a temporary advisory committee to the Governing Council for one year.

The association adopted a resolution asking that the Governor and the Legislature study the problem of the separate administration of health programs by a number of agencies with the view of consolidating them under competent medical direction such as that provided by the State Board of Health.

The granting of awards closed the business session. Approximately 380 members and guests, the largest attendance ever registered at an LPHA meeting, applauded the choice of Charles Manly Horton, M.D., general practi-

tioner of Franklin, La., as the recipient of the annual Dr. Felix Formento Memorial Award for meritorious activity to promote the public health program in Louisiana.

For long-time diligent and loyal service to public health, the LPHA presented Agnes Morris Memorial Awards to Sue Arnoult, nursing consultant, New Orleans Health Department; Natalie Nobles, assistant nursing supervisor, Caddo-Shreveport Health Unit; Felix Richard, St. Landry Parish Health Unit sanitarian, and Albert E. Riquelmy, sanitarian with the Calcasieu-Lake Charles Health Unit.

The association wound up its two-day conference with section meetings devoted to new approaches to the problem of effective control of communicable diseases.

Officers for 1960-1961 are:

President—Lucille Godelfer, laboratory technologist, State Board of Health, New Orleans

1st Vice-President—Madge Kelly, chief clerk, Ouachita Parish Health Unit, Monroe

2nd Vice-President—Odie Lee Gossett, nurse consultant, Monroe

Secretary—A. G. Owens, regional sanitarian, State Board of Health, New Orleans

Treasurer—George Ineichen, child safety consultant, State Board of Health, New Orleans

Pennsylvania Eyes the Sixties

"Challenge of the New Decade" was the theme of the Pennsylvania Ninth Annual Health Conference held August 14-18, at the Pennsylvania State University, University Park. The conference is co-sponsored by the Pennsylvania Public Health Association, Department of Health, Medical Society, and Health Council.

More than 1,000 people attended the first general session to hear Governor David L. Lawrence speak on the "Government's Role in Public Health in the Next Decade." The Governor reminded the group that "Enlightened public officials—at all levels of government—can meet any challenge when they have the support of the people they represent." Among other challenges is the need for more answers to human behavior. "Research in this field," he said, "may give us a new, more sensible approach to delinquency and addiction," for example. Public health problems listed by the Governor included alcoholism, silicosis, tuberculosis, highway safety, revision of legislation, waste disposal facilities, clean streams, air pollution, radiation, and the shortage of qualified public health personnel.

Sharing the platform with the Governor was C. L. Wilbar, Jr., M.D., Pennsylvania secretary of health, and Leonard W. Mayo, Sc.D., executive secretary, Association for the Aid of Crippled Children. In his address, "Challenge of the Sixties in Pennsylvania Health," Dr. Wilbar announced that plans have been completed for a public health survey in the state. The Johns Hopkins School of Public Health has contracted for the survey. Personnel from the University of Pittsburgh Graduate School of Public Health and the Public Health Service will also participate. "A year from now when the survey has been completed," Dr. Wilbar pointed out, "we will undoubtedly have a much more accurate and detailed picture of future needs," in a state where "we can reasonably expect to have over twelve million people by 1970."

Dr. Mayo, in "The Challenge of the New Decade," said that in the program of the sixties, "if it is to be a dynamic decade in medical care, public health and research must be based on three concepts—the unity of all medicine, health as a state of total well being, and health as a commodity." The goals he proposed for the next ten years are: meeting health problems of children; meeting the problem of chronic illness—America's number one health problem;

meeting the problem of the aged; making better use of existing personnel and facilities; and reviewing philosophy and methods.

Allen W. Cowley, M.D., president, Pennsylvania Medical Society, presided over the first general session. Eric A. Walker, Sc.D., president, Pennsylvania State University, extended greetings.

The second general session was chaired by William G. Mather, Ph.D., president, Pennsylvania Health Council. Speakers were W. Benson Harer, M.D., trustee, Pennsylvania Medical Society, on "Problems of the Aging"; David V. Auld, director, Sanitary Engineering, District of Columbia, Washington, D. C., on "Problems of the Physical Environment"; and Paul V. Lemkau, M.D., professor of public health, Johns Hopkins University, on "Problems of Mental Health."

Robert H. Conn, M.P.H., 1959-1960 president, PPHA, and chief, Community Health Section, State Health Department, opened the association's business meeting, at which each section chairman presented a three-minute activity report. Malcolm Merrill, M.D., president, APHA, was the guest speaker on the topic, "Public Health Now and in the Future." This included a summary of the APHA Task Force Report, and also dealt with personal, community, and environmental health, and with the biological, physical, and social environment. "It is obvious that personal and community health are inseparable from environmental health, and all parts of the environment are so interrelated that they must be considered parts of a whole," Dr. Merrill said.

Berwyn F. Mattison, M.D., executive director, American Public Health Association, was the speaker at the PPHA's luncheon meeting. He asked one of the most challenging questions of the conference in his paper, "How Much Health Do We Really Want?" Supplying part of the answer, Dr. Mattison pointed out some of the differences between health problems in the United States and those of other countries. Differences in living patterns affect the health goals set by other cultures. In this country, "Popular images of glamorous women and successful men created by the advertising people and movies usually include cigarettes and some form of alcoholic beverage," he said. "In spite of the growing concern of public health authorities about the extent of chronic alcoholism and a growing mass of evidence of an association between excessive cigarette smoking and lung cancer, the sale of these articles continues at an all time high." In conclusion: "we cannot cling longer to our old idea of 'health' and be satisfied that all people will seek it out. . . . There was no lay demand for increased parameters of human experience in outer space, for the development of untold new sources of energy, for speeds not seriously visualized by the man on the street; dedicated technicians kept thrusting forward in those fields. It is up to us as the dedicated technicians in health promotion and the prevention of disease to do likewise."

The PPHA's Annual Award of Merit was presented to Helen Vail Stevens, R.N., "in recognition of a career dedicated to the development of public health nursing services." The association's Honorary Membership was presented to Anna DePlanter Bowes, M.A., recently retired director, Division of Nutrition, Pennsylvania Department of Health, "in recognition of her outstanding work in the field of medical nutrition."

At the luncheon meeting of the Pennsylvania Health Council, Harald M. Graning, M.D., regional medical director, I and II, Public Health Service, spoke on "Crises in Public Health—Points for Immediate Attack." Included as objects on the target: poliomyelitis protection, population explosion and its

implications of health manpower shortages, and career development.

The conference program included special sessions on Health Fairs, Training, Public Health on the Local Level, Monitoring the Environment, New Machines in Health Education, Strike Back at Stroke, Crises in Public Health: Role of Voluntary Agencies, Role of Health Departments in Traffic Accidents, Narcotics and Dangerous Drugs, Community Mental Health Services, Implications of Skid Row Culture for Public Health Workers, Research, Nutrition and Its Implications for Public Health Education, Administration and School Health, and Laboratory Lectures and Workshops.

A special feature of the conference was the health test offered registrants. This included chest x-ray; tuberculin test; height, weight, and nutritional counseling; blood pressure; hearing test; blood sample for anemia and diabetes; and vision screening for glaucoma, including tonometry, visual acuity, and fundoscopic tests.

The PPHA officers for 1960-1961 are:

President—Tom F. Whayne, M.D., associate professor, University of Pennsylvania School of Medicine

President-Elect—Wilda Camery, R.N., director, Public Health Nursing, Allegheny County Department of Health

Secretary—E. Jane Petach, R.N., executive secretary, Tuberculosis and Health Society of Dauphin and Perry Counties

Treasurer—Dorothy Waller, M.A., assistant director, Division of Nutrition, Pennsylvania Department of Health

APHA Governing Council Representative—B. Russell Franklin, M.P.H., Philadelphia Department of Public Health

(EDITOR'S NOTE: The Journal is indebted to Robert H. Conn, M.P.H., outgoing president, PPHA, for the above report.)

American Public Health Association membership application blank on page XXXIII

Unemployed Viruses

"Most of the newer viruses are still unfamiliar to the nonspecialist; indeed their discovery has occurred so rapidly as to leave the medical world somewhat confused by their multiplicity. Progress has frequently been so rapid that the number of agents known and characterized has outstripped the number of clinical diseases which could be correlated with them."

John E. Hotchin: Virology Advances. Health News, February 1960.

EMPLOYMENT SERVICE

Annual Meeting Employment Service

An employment center will be located in Room 400 of the Civic Auditorium at the 88th Annual Meeting. The service will be sponsored by the California State Department of Employment, an affiliate of the U. S. Employment Service, and the Association. Professional personnel will be available to assist employers and employees. Vocational counseling will also be available.

Employers and candidates are urged to file beforehand. This should be done through your local state employment service office. Filing by October 21 is necessary if records are to be forwarded to the meeting. It will be possible to register at the meeting also. Early registering at the employment center will permit prompt activation of files.

A conference room will be available at the center for use by employers and applicants. Early registration will facilitate appointment arrangements.

The following pages present information for those seeking public health personnel and for those seeking positions in public health. Other information concerning vacancies and personnel available is on file in the Association office. Anyone wishing to have the benefit of this additional information can obtain it by writing to the Vocational Counseling and Placement Service of the Association.

Advertising space in these pages is available at special rates for the use of employers or individuals. The charges are $5 for the first 50 words or fraction thereof and $1 for each additional 10 words or fraction thereof. There is no charge to members or Fellows of the Association who desire to utilize the **Positions Wanted** portion of these pages. **Closing date** for receipt of advertisements is the first of the month preceding the desired month of publication. **All correspondence should be sent to the American Public Health Association, 1790 Broadway, New York 19, N. Y.**

POSITIONS AVAILABLE

Health Officers—$1,044 and $947. Director of medical services and director of preventable diseases, respectively, Maricopa County Health Department. Other positions open from time to time. Arizona State Merit System, Capitol Bldg., Phoenix, Ariz.

Public Health Physician—with administrative experience in the field of maternal and child health to act as chief, Bureau of Maternal and Child Health, in San Diego County Public Health Department. Annual salary $12,624-$13,920, plus 10 per cent if certified by appropriate American Board. For further information write County Civil Service, Room 403, Civic Center, San Diego, Calif.

Chief, Section of Hospitals—a key position in the department involving supervision of licensure programs of general hospitals, chronic and convalescent hospitals (nursing homes), and state-level administration of the Federal Hospital Survey and Construction Act. Staff includes trained engineer and experienced inspectors. Requires eligibility for Connecticut medical licensure and five years' training and/or experience in hospital administration. Write B. Dearington, Personnel Administrator, Connecticut Department of Health, State Office Bldg., Hartford, Conn.

Public Health Officer II—Vacancy with Hawaii State Department of Health. Requires M.D. and M.P.H. degrees and three years' public health physician experience, one of which must have been in the administration of a generalized public health service. Appointment may be made at any step within $878-$1,120 per month. Write to Recruitment and Examination Division, Department of Personnel Services, 825 Mililani St., Honolulu 13, Hawaii.

Health Director—Rockford, Ill. (population 130,000). Minimum qualifications: M.D. with training and experience in public health. Salary range $12,000-$14,000 per year. Submit resumé to Personnel Director, Old City Hall, 126 South First St., Rockford, Ill.

Epidemiologists or Other Public Health Physicians interested in clinical practice. For expanding decentralized program of all-purpose medical group in rural area. Academic environment and benefits program. Qualifications: eligibility for New York license, and preferably board eligible in internal or preventive medicine. Rip Van Winkle Clinic, Hudson, N. Y.

Pediatrician—for State Health Department. To act as pediatric consultant within the agency and work with professional and lay groups in the field. Included in work: hospital standards, school health problems, statistical studies, future program planning. Starting salary $12,240. Ohio medical license, one-year internship, at least two years' graduate training required; preferably Board of Pediatrics or eligible. Civil service position, vacation, sick leave, annual salary increments, and retirement plan. Staff appointment to state university if eligible. Address inquiries to Division of Child Hygiene, Ohio Department of Health, Columbus 15, Ohio.

Health Officers—Three excellent openings for local health officers. Salary range $12,120-$15,480; board certified $12,960-$16,320. **Epidemiologist-V.D. Control** opening, State Health Department, salary range $12,840-$14,340; board certified $13,320-$14,880. Starting salaries open, depending on qualifications. All positions require M.P.H. degree and some public health experience. For full particulars write Mr. A. T. Johnson, Personnel Director, Oregon State Board of Health, P. O. Box 231, Portland 7, Ore.

Medical Officer—Texas. Excellent opportunity for physician in rapidly expanding municipal public health department. Degree from approved medical school, license to practice in Texas, three years' general medical practice. One year of rotating internship may be considered equivalent to two years' general practice in fulfilling experience requirement. Salary within range of $7,800-$10,300 dependent upon previous experience. For application write Civil Service Board, 401 Municipal Bldg., Dallas, Tex.

Physicians—Board qualified or equivalent. Epidemiology: pediatrician director, Crippled Children and Maternal and Child Health program; and psychiatrist director of Mental Health program. Address inquiries and credentials to the Director of Public Health, Utah State Department of Public Health, 45 Fort Douglas Blvd., Salt Lake City 13, Utah.

Medical Health Officer—with M.P.H. and eligibility for licensure in Illinois. New bi-county health department to begin operations at once. In the heart of the recreation area of southern Illinois; population approximately 100,000. Beginning salary $15,000-$18,000, plus travel. Opportunity to develop department and program. Southern Illinois University in adjacent county. Write Louis Helleny, Secretary, Board of Health, Herrin, Ill.

Director, Bureau of Maternal and Child Health—Plans and directs a state-wide program for the conservation and improvement of maternal and child health; coordinates and supervises the activities of the bureau. Major activities include the child guidance, school health, and nutrition programs. Requires M.D. and M.P.H. degrees, certification by the American Board of Preventive Medicine or Pediatrics, preferably the latter, and license to practice medicine in Wisconsin. Beginning salary $18,648 per year; maximum salary $20,448 per year. Civil service, vacation, sick leave, Social Security, retirement, group health and life insurance benefits, travel allowance. For applications and further information write R. J. Siesen, Personnel Officer, State Board of Health, State Office Bldg., Madison 2, Wis.

Hansen's Disease Facility Director, M.D.—Position with the Hawaii State Department of Health. Responsible for administering a Hansen's disease treatment program and the administration of the Hansen's disease treatment center. Requires four years' physician experience, two years of which shall have been in an administrative capacity in a hospital, medical institution, or a comparable health agency or program; graduation from an accredited medical school; and eligibility for a medical license in Hawaii. Appointment to the position may be made at any step within the range of $10,536-$13,440 per annum. Write for application and further information to Recruiting and Examining Division, Department of Personnel Services, 825 Mililani St., Honolulu 13, Hawaii.

Institution Medical Services Director—Position with the Hawaii State Department of Health. Responsible for the medical, dental, laboratory, and nursing care services in an institution for the mentally retarded. Requires eligibility for certification by the American Board of Pediatrics, Internal Medicine, or Psychiatry and Neurology; and eligibility for a medical license in Hawaii. Appointment to be made at any step within the range of $10,032-$12,804 per annum. Write for application and further information to Recruiting and Examining Division, Department of Personnel Services, 825 Mililani St., Honolulu 13, Hawaii.

Alcoholism Program Director—Challenging opportunity to develop and head up a new state alcoholism program centered around education and research pertaining to the causes, detection, and treatment of alcoholism and rehabilitation of alcoholics. Desirable qualifications: College graduate with a background in social work and a minimum of

—PUBLIC HEALTH OPPORTUNITIES IN ILLINOIS—

Local Health Officers — $15,000 - $19,200

Twelve positions in county, multiple-county, and urban health departments. Salary dependent on training, experience, and assignment. All positions require medical degree and internship approved by the AMA; one year postgraduate public health study or certification in preventive medicine-public health; two years' full-time experience in public health practice or equivalent; United States citizenship; **eligibility for Illinois Medical License.** Employment possible while awaiting licensure. Social Security or Municipal Retirement Plan.

Chief Toxicologist — $18,000 - $20,000

To establish and administer a state-wide toxicological service, and to plan and operate laboratories therefor. Directs and supervises work of toxicologists, chemists, etc. Works with law enforcement agencies, coroners, pathologists, etc. This is a new function and offers a real challenge. Requirements: Ph.D. degree in toxicology or related science; ten years' experience in toxicologic work. **Merit system examination.**

Chief Public Health Educator — $9,960 - $12,480

To plan, organize, and supervise the state-wide program of public health education. Location: Springfield, Ill. Requirements: master's degree in public health education and Ph.D. in education or social sciences; ten years' responsible experience. **Merit system examination.**

Chief, Bureau of Statistics — $9,360 - $11,880

To plan and direct the state-wide service in vital records and statistics. Administers over-all activities of major programs in statistical analyses and research, and in registration of vital records. Requirements: College graduation with major courses in statistics or mathematics; one year graduate study in biostatistics; administrative ability; and eight years of progressively responsible experience in public health statistics and registration. **Merit system examination.**

Regional Nutritionists — $4,920 - $6,060

To carry out the state-wide program in nutrition education in a region of the state and to provide nutrition consultation and advisory services to official and voluntary agencies, groups and individuals within the region. Requirements: College graduation with major courses in nutrition; one year graduate study leading to master's degree in public health nutrition; and two years' experience as a nutritionist in a health agency. **Merit system examination.**

Public Health Nursing Supervisors — $7,200 - $9,000

For county, multiple-county, and urban health departments, working with health officer to plan and implement public health program; develop and expand family-centered nursing services; supervise, guide and evaluate nursing personnel. Salary dependent on training, experience, and assignment. Requirements: Graduation from accredited school of nursing; eligibility for Illinois license as registered nurse and certified public health nurse; bachelor's degree with one year of study in public health nursing; four years' experience, two of which have been as public health nurse under qualified supervision.

All positions under merit system provide liberal retirement benefits.
All positions provide for vacation, sick leave, and holidays.

For further information or application, contact L. L. Fatherree, M.D., Director, Illinois Department of Public Health, State Office Building, Springfield, Ill.

three years' experience in a state or local alcoholism program. Administrative experience is a must. An M.P.H. would be desirable. Salary starts at $9,420; maximum $11,280. Civil service, vacation, sick leave. Travel with expenses paid. Write to Frederick H. Wentworth, M.D., Assistant Director, Ohio Department of Health, Room 306, Ohio Departments Bldg., Columbus 15, Ohio.

District Health Officer—Public health administrator of a district area; district epidemiologist. Plan, organize, supervise work of professional staff consisting of engineers, nurses, sanitarians, nutritionists, dental hygienists, health educators, and social workers. Requires M.D. and M.P.H. degrees and license to practice medicine in Wisconsin. Salary: beginning level $12,048-$15,048 per year based upon number of years of residency training and certification by the American Board of Preventive Medicine. Maximum salary $16,848 per year. Civil service, vacation, sick leave, Social Security, retirement, group health and life insurance benefits, travel allowance. For applications and further information write R. J. Siesen, Personnel Officer, State Board of Health, State Office Bldg., Madison 2, Wis.

Director, Local Health Services—Work with district health officers and professional staff in improvement of local health services. Act as liaison between district and central office staff. Requires M.D. and M.P.H. degrees, two years' residency, certification by the American Board of Preventive Medicine, and license to practice medicine in Wisconsin. Beginning salary $16,248 per year; maximum salary $18,048 per year. Civil service, vacation, sick leave, Social Security, retirement, group health and life insurance benefits, travel allowance. For applications and further information write R. J. Siesen, Personnel Officer, State Board of Health, State Office Bldg., Madison 2, Wis.

Public Health Nurse—for the city of Pasadena, Calif. Salary $466-$568 per month. To perform field and clinical work. Excellent working conditions and liberal benefits. Requires R.N. and P.H.N. from the state of California. Direct inquiries to Personnel Director, Pasadena City Hall, 100 North Garfield Ave., Pasadena, Calif.

Supervising Public Health Nurse—Immediate opening; for a five-county farming and lumbering area in northcentral Idaho which has a part-time medical director and ten public health nurses. Near the University of Idaho. Generalized program. Position requires a bachelor's degree and four years of public health nursing experience. Address inquiries to Roy W. Eastwood, M.D., North Central District Health Department, Box 637, Lewiston, Idaho.

Public Health Nurse—Challenging position in a Detroit suburb of 115,000 for one with experience and training in public health nursing. Salary $4,936-$5,674 per year. Application and bulletin available from Personnel Department, City Hall, Dearborn, Mich.

Public Health Nurses—Salary range $395-$481 (five-step range). College degree in public health nursing. Experience in public health not necessarily required. P.H.N. certification required to meet State Health Department nursing requirements. Three weeks' vacation per year. Retirement and Social Security benefits. Work 37½ hours per week. Thirty-five miles north of San Francisco. Generalized program. Contact Henry G. Mello, M.D., Solano County Health Officer, 228 Broadway, Vallejo, Calif.

Orthopedic Nursing and Physical Therapy Consultant III—Progressive crippled children's agency has an opening due to retirement. Work as a consultant in an assigned area giving guidance and counsel to local workers in services for crippled children. Minimum requirements: B.S. degree in public health nursing, graduation from an approved school of physical therapy, and three years' experience. Salary $6,389-$8,164. All Michigan Civil Service benefits, Social Security, and retirement benefits. Write Nursing Division, Michigan Crippled Children Commission, 252 Hollister Bldg., Lansing 4, Mich.

Public Health Nurse III—Directs all public health nursing activities in an assigned district. Bachelor's degree plus two years' experience in public health nursing. Salary $381-$464. Sick leave, 11 paid holidays, three weeks' vacation, pension plan. Write City Department of Personnel, 235 Municipal Courts Bldg., St. Louis 3, Mo.

Public Health Nursing Consultant—Supervisor of maternal and child health phase of a public health program. Bachelor's degree plus four years' experience in public health nursing. Salary $421-$511. Sick leave, 11 paid holidays, three weeks' vacation, pension plan. Write City Department of Personnel, 235 Municipal Courts Bldg., St. Louis 3, Mo.

Public Health Nurses—for generalized public health nursing in New Mexico Department of Public Health. Opportunities for advancement, retirement plan, and other fringe benefits. Write Merit System Director, 136 W. Palace, Santa Fe, N. M.

Nurse Research Associate—for interesting research project in northern New Mexico. Master's degree and experience in research, college teaching, or public health nursing required. Entering salary $675-$745 a month. Write Merit System Director, 136 W. Palace, Santa Fe, N. M.

Community Mental Health Consultant—for state-level mental health nurse consultant position in Santa Fe. Graduate degree and experience required. Entering salary $535-$605. Excellent climate, recreation, cultural events. Write Merit System Director, 136 W. Palace, Santa Fe, N. M.

Consultant-Public Health Nurse—A creative, imaginative person with a master's degree and progressive public health nursing experience is being sought by the Division of Public Health Nursing, Public Health Services of Philadelphia, to work in a newly created position to help develop a broad program for the school-age child. The salary offered is $6,717-$7,357 with generous fringe benefits. For details write to Madelyn N. Hall, Director, Division of Public Health Nursing, Department of Public Health, 500 South Broad St., 2nd Floor, Philadelphia 46, Pa.

Director, Public Health Nursing—to guide a staff of 25 nurses in a generalized program. Beginning salary $6,442-$7,124 depending on qualifications. Requires bachelor's degree, master's degree in public health or public health nursing, and six years' experience, including one year under supervision and two years of supervisory experience on the local level. Merit system with regular salary increments, combined state retirement system and Social Security, generous annual and sick leave. Long established, progressive city-county department in cultured, historic, and rapidly developing community with pleasant climate. Close cooperation with medical college, including school of nursing. New health center. Travel allowance. Write Leon Banov, M.D., Director, Charleston County Health Department, Charleston 29, S. C.

Supervisors—generalized, for progressive combined nursing service. Active service related research. Opportunity for advancement within the organization. Preparation in public health nursing, three years' experience under good supervision and courses in Principles of Supervision required. Degree desirable. Apply to Marie L. Lowe, Director of Nursing, Instructive Visiting Nurse Association—City of Richmond, Department of Health, 223 South Cherry St., Richmond, Va.

Public Health Nurse III (District Advisory Nurse)—Give guidance and counseling to all public health nurses in a multiple-county area regarding community organization and relationships, program planning, public health nursing technics, records, and reporting. Responsible for inservice education program for local public health nurses and evaluation of nursing services. Salary range $5,700-$6,780, plus travel allowance. B.S. degree with major in public health nursing and three years' generalized experience as a public health nurse. Special requirement: registration or eligibility therefor as a registered nurse in Wisconsin; certification or eligibility for certification as a public health nurse in Wisconsin. Write Miss Ione M. Rowley, Director, Public Health Nursing, 119 Monona Ave., Madison 3, Wis.

Health Educator III—$403 per month. State Department position. Small but progressive health education operation. Must have M.P.H. and one year of experience. Apply Arizona Merit System, State Capitol Bldg., Phoenix, Ariz.

Health Educator—Southern Appalachian area. Challenging opportunity for young, enthusiastic person to take full responsibility for mobile health unit which will have audio and visual exhibits and feature the Transparent Talking Woman. Suitable training required. Apply to P. F. Ayer, Executive Secretary, Council of the Southern Mountains, Inc., Berea, Ky.

Public Health Educator—to plan and carry out education programs on a county-wide basis in a well established County Health Department. Population 84,000. Liberal vacation and sick leave, hospitalization plan (one-half paid by county), retirement and longevity benefits. Salary $5,328-$6,072 per year. **Box HE-96,** Employment Service, APHA.

Public Health Educator III (Dental Hygienist)—Assist in developing dental health programs for preschool and adult groups in a several county area. Coordinate dental health education activities with overall health education program. College graduation, a year of graduate training in an accredited school of public health, and two years' experience. Licensure or eligibility for licensure to practice dental hygiene in Wisconsin essential. Salary starts at $6,060; maximum $7,200. Civil service, vacation, sick leave, Social Security, and retirement benefits. Write R. J. Siesen, Personnel Officer, State Board of Health, 400 State Office Bldg., Madison 2, Wis.

Engineers—State Department of Health. Two responsible positions for trained and experienced sanitary engineers. Starting salary for one position is $626 per month, for the other $541 per month. Apply Arizona Merit System, State Capitol Bldg., Phoenix, Ariz.

Senior Public Health Engineer—Salary range $8,300-$9,500 by annual increases of $300 from minimum to maximum. Appointment to be effective January 1, 1961. Minimum qualifications: Bachelor's degree in civil or chemical engineering and five years of satisfactory sanitary or public health engineering experience, or bachelor's degree in sanitary or public health engineering and four years of satisfactory sanitary or public health engineering experience; license to practice

professional engineering in New York State or eligibility for examination for such license. Paid vacation, sick leave, holidays, retirement plan, and Social Security. Engineer shared between Genesee and Wyoming County Health Departments (New York). Write to LaVerne E. Campbell, M.D., Commissioner of Health, 127 North St., Batavia, N. Y.

Bacteriologist—for the Colorado State Health Department. Offices in Denver. Requires college degree with major in bacteriology. Salary starts at $386 with a maximum of $492.

Industrial Hygienist—for the Colorado State Health Department. Location Denver and Western Slope (Durango or Grand Junction). Position requires college degree with major in chemistry, industrial hygiene, or sanitary engineering, and four years of experience. Salary $517 to start with a maximum of $660.

Milk Sanitarian—for the Colorado State Health Department. Salary starts at $469 with a maximum of $598. Requires college degree with specialized experience in milk sanitation.

Health Educator—for the Colorado State Health Department. Offices in Denver. Position requires a master's degree in public health education. Salary starts at $492 with a maximum of $570.

Public Health Engineer—for the Colorado State Health Department. Offices in Denver. Salary $628-$727. Position requires college degree in sanitary, chemical, or civil engineering, and two years of experience in public health or sanitary engineering.

Address inquiries for above Colorado positions to Dalton Roberts, Administrative Officer, Colorado State Department of Public Health, 4210 E. 11th Ave., Denver, Colo.

Sanitary Engineer—Fairfax County, Va. Starting salary $8,244 with increments to $10,296. Master's degree and three years' experience in sanitary engineering or five years' experience without master's degree. Liberal vacation, sick leave, retirement benefits. Merit system status. Write Director of Personnel, State Health Department, Richmond, Va.

Sanitarian Opportunities—Several sanitarian positions are now open in the Philadelphia Department of Public Health due to program expansion and recent promotions. Starting salary $5,347; Blue Cross, Blue Shield, life insurance, and other liberal fringe benefits. For interviewing and examining contact Miss Joyce Tooks, Personnel Officer, Public Health Services, 500 South Broad St., Philadelphia 46, Pa.

Public Health Nutritionist—Consultant to professional staff and community leaders on nutrition programs; patient education in nutrition clinics. Master's degree in nutrition and two years' paid experience in adult nutrition education (public health, college teaching, clinic or dietitian). Must be United States citizen. Salary $4,850-$6,290. Bureau of Nutrition, Health Department, 93 Worth St., Room 714, New York 13, N. Y.

Microbiologist—Salary range $415-$505 (five-step range). College degree in bacteriology or microbiology major. Experience of one year in public health or similar laboratory. Combination of education and experience required. Eligibility for certification in public health in the state of California. For confirmation of certification eligibility write to Mrs. Lucy French, State Department of Public Health, 2151 Berkeley Way, Berkeley 4, Calif., or contact Henry G. Mello, M.D., Solano County Health Officer, 228 Broadway, Vallejo, Calif.

POSITIONS WANTED

On Box Numbers, Address APHA at 1790 Broadway, New York 19, N. Y.

Director of Student Health—Position with health education responsibility desired. Age 38; Fellow, American Academy of Pediatrics; M.P.H. Experience includes teaching preventive medicine, five years of private clinical practice, school health work. Prefer New England area. **Box PH-9,** Employment Service, APHA.

Commercial Advertisements

All communications on the following commercial advertisements should be sent to Burneice Larson, Medical Bureau, Suite 605, 900 North Michigan Avenue, Chicago 11, Ill.

OPPORTUNITIES AVAILABLE

(a) Director of West Coast County health services; medical director 350-bed hospital. (b) M.D., health commissioner, county seat near major midwest industrial center; $17,000. (c) Foreign appointment, woman M.D., maternal and child health; American overseas oil operations; excellent company benefits; all modern air-conditioned facilities. (d) Out-patient nurse supervisor; busy department, Greater Manhattan, New York, $5,000 up. (e) P.H. nurse supervisor, interpret program to community; assist planning for area; progressive department, Southern California, to $7,000. (f) Director of nurses, wealthy southern ocean city health department, $7,200 start.

SITUATIONS WANTED

(1) M.D. health commissioner, F.A.C.P.: Diplomate, Preventive Medicine; 15 years' experience aviation, research medicine. (2) Health education sanitarium, M.P.H. University of Michigan, seven years' experience environmental health. (3) Industrial Nurse Administrator, M.P.H. Yale; ten years' experience industrial occupational health, research.

Too Many or Too Few

"In Britain and other of the more favored countries there are too many sanatorium beds: in India and many other countries there are too few. India is estimated to have 2½ million people with active tuberculosis requiring treatment but only 23,000 tuberculosis beds for them—100 patients per bed."

Mass Treatment of Tuberculosis. The Lancet, November 21, 1959.

BOOK REVIEWS

All reviews are prepared on invitation. Unsolicited reviews cannot be accepted.

ALGAE IN WATER SUPPLIES—By C. Mervin Palmer. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio: Public Health Service, Department of Health, Education, and Welfare. Washington, D. C.: Government Printing Office, 1959. 88 pp. Price, $1.00.

The objectives of the author of this excellent little manual were: (a) to provide useful information on algae of water supplies; (b) to provide keys and illustrations which might be an aid to the identification of algae important in water supplies; (c) to provide a basic bibliography which would be of value to the practical worker concerned with algae or algae problems.

These aims have been achieved in a very satisfactory manner by Dr. Palmer, without overemphasis of either the practical features or the complex taxonomic aspects of the topic. Primarily, the manual deals with fresh water algae. Excluded are algae of unusual habitats and those growing in waters which are not potential sources of water supply. Marine and estuarine algae are mentioned but are not considered in any detail.

The ever-increasing shortage of good water and its growing importance to the over-all welfare of man is very adequately summarized in an introductory chapter by C. M. Tarzwell, who also points out the need for coordinated and more scientific studies of the practical problems which confront water plant operators. In the chapters which follow the author, tersely and clearly, discusses the significance which may be attached to algae in water supplies; the identification of algae; tastes and odors associated with algae growth; algae as filter cloggers and as a source of additional problems related to water supply; clean water algae versus those found in waters which are polluted; free floating, plankton algae as contrasted to attached forms; the methods for enumeration of algae; and the ways in which algae growths may directly or indirectly be useful to man. The last chapter covers general methods which can be employed for the control or prevention of algae growth.

A carefully selected bibliography follows each chapter and a general bibliography is provided at the end of the text; the latter includes a total of 146 references. Although a number of useful publications are missing from the list, it will be noted that most of these can be found as secondary references in the bibliography.

Word keys for the identification of algae are notoriously difficult and usually unsatisfactory, except in the final steps of identification. However, Dr. Palmer's key, when associated with his line drawings and six excellent colored plates, is quite workable. It will be very helpful to the meticulous worker who is also a good observer. A glossary is provided at the end of the manual to aid the users of the key and to orient persons who may be lacking in the necessary scientific vocabulary.

Recent revisions of the taxonomy, especially in the coccoid Myxophyceae, have brought about changes in the names of algae which as yet are not widely known and which are not generally included in current classical texts. The author of the manual has recognized this problem by using both the old and the new name in his text and by providing a table which indicates the existing synonomy of 38 genera and species common to water supplies.

For its size, this publication is one of the most valuable references currently

available to persons who are interested in surface water quality, and there is none which can compete with it in terms of price. The colored plates depicting taste and odor algae, filter clogging algae, polluted water algae, clean water algae, plankton and other surface water algae, and aglae growing on reservoir walls are in themselves worth the purchase price of the publication.

Every practical worker will find the manual a boon. However, it is hoped that more serious workers will eventually wish to avail themselves of the added vistas of knowledge which can be acquired by consulting the many excellent texts that are listed in the bibliography. This publication fulfills a long-felt need and constitutes an important contribution to the fields of public health biology and water supply technology.

THEODORE A. OLSON

HENRY E. SIGERIST: "ON THE HISTORY OF MEDICINE" — Edited by Felix Martí-Ibañez. New York, N. Y.: MD Publications (30 East 60th St.), 1960. 313 pp. Price, $6.75.

The special value of history in illuminating the changing nature of medicine and even directions for present-day medical science is nowhere more clearly and persuasively presented than in Henry Sigerist's essays. It is superfluous to elaborate for this audience the overwhelming contribution Sigerist made to medical history and social medicine. This collection, edited by a friend and colleague, but selected by Sigerist himself, is broadly representative and very much alive with the warmth of his personality, his sensitive intelligence, and his skillful analysis of events and people. Each of the essays imparts an aspect of the mind of the scholar, from the early days of learning to the later years in his chosen career line.

In "University Education" he writes, for example, "I had become increasingly interested in the sociological approach to history and in the sociology of medicine. I saw that the application of medical knowledge to society was made so difficult by a variety of social, economic, political, religious, and philosophic factors that had to be investigated if progress was to be achieved."

From these essays, whether he tells of his own education or that of others, or explores the impact of society on medical knowledge and medical practice, there is evident his consuming interest in the betterment of man's lot. So he says of himself (though writing of Paracelsus), "He wanted to understand the world in which he was living and man's part in it in health and disease." History was the professional tool he used to understand and explain his fellow man, and medical history a refinement that enabled him to explore social relationships in sickness and in health.

As he says in "The Social History of Medicine":

> "The history of medicine is both history and medicine. It is one aspect of the history of civilization and part of the theory of medicine. The historical analysis is a method that can be applied . . . to clarify concepts, to make trends and developments conscious so that we may face them openly and may act more intelligently. When you pursue your historical studies into the present, you imperceptibly enter the field of sociology and begin to see that an infinite number of nonscientific factors, social, economic, political, philosophical, religious, may well determine success or failure of medicine, factors which must be investigated."

Perhaps, too, there is a lesson to be drawn by public health workers from principles not expressed directly in these essays. The fact that many of the conclusions Sigerist drew and courses of action which he recommended were politically unpalatable did not deter him. He willingly paid a heavy price for his heterodoxy. Since he considered his conclusions historically sound and socially necessary, he engaged actively

in organizational work to bring about the desired effect.

He had a mind adapted to many times, and there was no gulf for him between the man of yesterday and the many of today. Out of his historic humanity he poured forth the writings drawn together into this volume. The essays are moving because of his sympathetic understanding and felicitous expression, enlightening because of the historical insights and range of knowledge, and inordinately stimulating to a generation that has still to meet most of the challenges Sigerist presented as the social needs of medical practice.

"Society more and more feels responsible for the welfare of all its members. It has placed the means of retaining or regaining health within the reach of everyone, and in return it may well demand health of the individual. We may like this development or we may dislike it, but we cannot help it. All of us are dependent on each other. If large parts of the population suffer, it is quite obvious that the rest will be affected by it. To us medical men, the idea that one sick organ affects the whole organism should be familiar." ("The Physician's Profession.")

From these essays it becomes apparent why Sigerist inspired such loyalty and devotion in his students and friends. His social dedication gave his work an added dimension. His own enthusiasm, the prodigies he demonstrated, the old-new worlds he opened, his benign wit, called forth disciples. The review may aptly be closed with this quotation,

"What I wrote I have lived, and it has enriched my life so tremendously that I thought that others might benefit from my experience." ("The Physician's Writing and Reading.")

GEORGE A. SILVER

ALCOHOLISM — AN INTERDISCIPLINARY APPROACH—Edited by David J. Pittman. Springfield, Ill.: Thomas (301-327 East Lawrence Ave.), 1959. 96 pp. Price, $3.75.

This is a valuable summary. It is a thumbnail sketch of the current status of research in alcoholism. The book is an outgrowth of the first annual conference on community mental health sponsored by the Social Science Institute at Washington University. The book has been divided into two sections which reflect the organization of the conference. The first section contains five original papers from researchers who summarize the current status of alcoholism research from the disciplinary points of view of physiology, psychology, psychiatry, and sociology. These summaries are concise and brief, and because of this in some instances stimulate the reader's interest but do not satisfy it. However, a good bibliography accompanies each paper which is useful for easy reference. The second section includes five papers on the next steps in research in alcoholism. These papers summarize general concepts of research approach and research needs, and give an over-all perspective for future research. No attempt is made to specifically pursue detailed research proposals. The tone of the entire book emphasizes the need for interdisciplinary research in alcoholism.

JOHN R. PHILP

TABULATING EQUIPMENT AND ARMY MEDICAL STATISTICS — Edited by Brig. Gen. Albert G. Love, USA (Ret.); Col. Eugene L. Hamilton, M.S.C., USAR; and Ida Levin Hellman, M.S.C. Washington, D. C.: Office of the Surgeon General, Department of the Army, 1958. 189 pp., indexed.

The authors, on page 106 of this volume, cite a quotation attributed to Vegetius' Art of War: "An army raised without due regard to the choice of recruits, was never yet made a good army by any length of service." The truth of this adage is amply demonstrated by this volume, not only with regard to the problem of recruiting an army, but also in maintaining its health in war and peace. Much of the material presented in this volume has implications as well for civilian programs. The authors set forth the evolution of the

army medical statistics program and, as stated in the preface, "trace the development of medical records of the army in their individual service function, their compilation as medical statistics, and in their analysis leading to any knowledge. . . . It is an excellent record of the evolution of medical statistics in effective use, rather than as statistics gathered for their own sake."

After an introductory chapter describing the establishment and development of the Medical Department of the Army, the second chapter traces the early development of medical records in the Army. Nevertheless, "When the Spanish American War began, there was no sick and wounded report from which vital statistics experience could be assembled rapidly and efficiently." How this experience was obtained is presented in the next three chapters which deal with the development of the system of medical records and machine tabulating methods to deal with the huge job of summarizing, analyzing and making available the tremendous volume of medical statistical intelligence present in the medical records.

Chapters VI and VII deal with special and other statistical studies in World War I. These two chapters are among the most interesting in the book. They demonstrate that the medical statistical program of the Army has implications which extend beyond the military to throw light on problems of civil life as well. For example, the authors point out that the analysis of the selective service physical examinations had "important military bearing, since it indicated the proportion of men available for the different types of military service. It was important from the standpoint of the social and industrial life, since it would give some insight into the availability of the American population for the various occupations which the social organization required. It had social medical bearing, since it indicated the physical and mental status of the population in various sections of the country under the different sanitary conditions that prevailed and with the varying opportunities for medical and surgical treatment."

In addition to the analysis of the selective service examinations the authors describe a number of other studies which were carried out on World War I medical records and reports of physical examinations. Some of these studies, are of considerable interest today. Thus the studies on hospital requirements have many of the earmarks of operations research and the biometric studies of army officers contain epidemiological observations of interest in regard to the problem of heart disease.

The remainder of the book deals with the changes instituted in the medical records, reporting and tabulating procedures since World War I and particularly with the adaptations necessary to deal with the enormous growth in the size of the Army during World War II and the complexities of a global war. The manner in which this was handled is in itself an exceedingly interesting story.

The authors close with the hope that "those administering the Army will be as wise as the Founding Fathers of the Medical Department and that there will be continued encouragement and support for the satisfactory compiling, analysis, and publication of both current and permanent statistics." The record of the medical statistical program through the years as set forth in this book amply justifies this hope.

PAUL M. DENSEN

BEHAVIORAL CHANGE IN THE CLINIC— By Gerald R. Pascal. New York, N. Y.: Grune and Stratton (381 Fourth Ave.), 1959. 128 pp. Price, $4.75.

This is a theory-packed, fascinating, and tough book. It is tough because it requires several re-readings in order

to understand the author's theory and proposed methodology for studying the problem of changing gross human behavior in a clinic.

The author's basic formula is

$$PD = \left[\frac{f\ (S\ .\ H\ .\ 1).\ E}{S_r\ \ H_r\ \ P} \right].$$

PD represents psychologic deficit and is the individual's pattern of deviancy on a number of measures: physical condition, intellectual ability, age, body type, responses to environmental stimuli, medical condition, and so forth. The remaining symbols of the above formula are extensions of the traditional formulation stated by theoretical psychologists —C. L. Howell, E. C. Tolman, and Kurt Lewis. Behavior is a function of the environment and the personality of the individual or $b = f(P \times E)$. In Pascal's expansion of this formulation "S=stress postulated for the particular individual, S_r=stress more prepotent in the hierarchy of stresses than S; H= deficit positive habits, H_r=defensive habits; P=psychophylaxsis and E= environment" (page 28).

Each of the components of Pascal's formula are elaborated in separate chapters in this small volume. In presenting his analysis of each of these concepts the author reviews the field and then draws from his experiences and experiments cases which illustrate them. The reader found the chapter on stress one of the best discussions of this concept in the literature.

The author suggests three basic approaches to behavioral change. The first type is called environmental manipulation and here the basic objective is to change a stressful environment or to remove the subject who is under stress from this type of situation. A second approach likewise is to reduce stress postulated for the particular individual and by increasing his defensive habits or H_r. The third approach is an effort to extinguish the patient's deficit-positive habits. The patient undergoes a series of trials in a stimulus situation which closely resembles the original one under which the habits were initially acquired and these trials are "nonrewarded."

The author is aware of the limitations of his conceptualization and the difficulties in explaining the complicated concepts with which he is working. Candidly he says, "The student is warned that, although the formulation above seems simple, the exposition to follow is complex and not always clear not even to the author. The formulation can be thought of as a guide, a framework on which to hang tentative hypotheses, ideas and clinical and laboratory concepts" (page 28). Even with this warning this book presents a logical theoretical schema as a basis for understanding the processes of behavioral change in the clinic setting.

MARVIN B. SUSSMAN

THE CHEMICAL ANALYSIS OF AIR POLLUTANTS (Vol. 10)—By Morris B. Jacobs. New York, N. Y.: Interscience Publishers (250 Fifth Ave.), 1960. 430 pp. Price, $13.50.

During the last ten years, the subject of air pollution has engaged the interest of an increasing number of investigators. The number of both research studies and control investigations has increased greatly over the past five years. With this increase in the number of studies, there have been developed a large number of chemical and microscopic technics for the determination of both particulate and gaseous air pollutants.

The present volume is devoted to a presentation of some of the technics for the sampling of both solid and gaseous air pollutants and a detailed discussion of many methods for the analysis of pollutants. It is well illustrated with line diagrams and some photographs, many of which are of value.

The volume presents an evaluation of

some of the chemical methods of analysis. However, in some instances where two or more methods of analysis are described, the reader is often left without a critical evaluation of the merits of the methods presented. Such an evaluation might serve as a valuable guide in the selection of the technic for a particular problem at hand.

In spite of this criticism, the volume should be a very useful guide for the air pollution laboratory.

LEONARD GREENBURG

FIRST AID — DIAGNOSIS AND MANAGEMENT (5th ed.)—By Colin Pueseow. New York, N. Y.: Appleton-Century-Crofts (35 West 32nd St.), 1960. 432 pp. Price, $6.25.

This handbook very completely treats not only the types of injury and methods usually included as "first aid" but additionally discusses injuries and treatments which might be included as first-aid measures in time of war or disaster, or which might have to be used as first aid in isolated conditions, but which are hardly applicable to ordinary peacetime circumstances. In the preface the author emphasizes the necessity of knowing limitations of ability but this precaution gets a bit buried later in the text. It is the opinion of the reviewer that the description of definitive treatment, in spite of the author's protest, may lead persons trained in first aid to undertake procedures which they should not perform. The value and advisability of such descriptions is questioned.

THOMAS R. HOOD

THE HEALTH OF BUSINESS EXECUTIVES—The transactions of a one-day conference. November 20, 1959. London, England.: The Chest and Heart Association (Tavistock Sq., W.C. 2), 1960. 128 pp. Price, 15s; $3.25

The series of papers presented in this pocket-sized book will be very useful to the full-time industrial physician. There is not complete unanimity among the participants as to special medical problems among executives. There is agreement that executives are not expendable.

A medical director can adapt much in the discussions on such topics as stress, fatigue, exercise, vacations, travel, self-medication, circulatory problems, and diseases of the chest, to his own top echelon group. Portions of the book could be read with profit by the executive with a medical problem in one of the areas covered.

CLYDE M. BERRY

RECENT STUDIES IN EPIDEMIOLOGY—Edited by J. Pemberton and H. Willard. Springfield, Ill.: Thomas (301-327 East Lawrence Ave.), 1959. 203 pp. Price, $5.75.

This easily readable volume represents a collection of papers on epidemiological methodology presented in September, 1957, at Noordwijk Aan Zee, Holland, by the Study Group on Current Epidemiological Research. The 18 contributors representing ten countries have presented a series of vignettes of current studies in epidemiology grouped by the editors into distinct categories of sources of data and applications. The reader searching for detailed presentations of data and the ultimate in analysis will be disappointed, for the purpose of these papers is rather to emphasize the methods of approach to a problem and methods of analysis utilized. As such, an individual paper may on casual inspection appear sketchy at times, but attention by the reader to the grouping of the papers under such headings as "The Use of Existing Records in Epidemiological Studies," and "The Ad Hoc Field Survey—Getting Your Own Data," and sections on applications of methods to less developed areas, mental illness, evaluation of health needs and services and to general practice, will quickly reveal the intent of this publication.

This is not a comprehensive textbook in epidemiology for which there

continues an unfulfilled demand. Nor is this a didactic presentation of methodology, but rather a palatable collection of concrete, specific studies completed or in progress and representative of the types extant at the present time.

Included are studies to satisfy the interest of any student or worker in any segment of the infectious or chronic disease fields. Limitations of data and their interpretations are discussed in such papers as "Cancer of the Lung and of the Nose in Nickel Refiners" by Doll and "Difficulties of Definition and Observer Error in Medical Surveys" by C. M. Fletcher. Explorations in relatively new fields for epidemiological applications are represented by such studies as "Ulcerative Colitis in Norway" by Ustvedt and "An Investigation of Institutional Facilities Required for the Care of the Mentally Sick" by McKeown.

The book is recommended for students and workers in epidemiology as an adjunctive publication which will provide breadth of information and insight into problems of methodology.

L. M. SCHUMAN

AGING AND SOCIAL HEALTH IN THE UNITED STATES AND EUROPE—Report of an International Seminar, Merano, Italy, July 9-13, 1957. Ann Arbor, Mich.: Published and distributed for the Social Science Research Committee, International Gerontological Association, by the Division of Gerontology, University of Michigan (1510 Rackham Building), 1959. 186 pp.

This is a report of an International Seminar which was attended by 27 experts in the field of gerontology from Europe and the USA. The purposes of the seminar were to give European and American research workers in the psychological and socioeconomic aspects of aging an opportunity to exchange ideas and experiences and to explore the potentialities of parallel or cross-cultural research. Included are papers on the following topics: Family Relationships, Housing, Income and Economic Security, Labor Force Participation, Mental and Physical Health, and Uses of Free Time. These are covered in 19 articles by specialists in various fields. Throughout the report a special emphasis has been placed upon prevention and on programs to provide opportunities for the development of the potentialities of older persons. All papers contain suggestions for further research.

The four papers on the economic aspects describe methods of measuring the cost of older persons to the community in relation to retirement and employment. All are of a high standard and have useful discussion and reviews of methodology. The four papers on health and well-being stress the importance of developing quantitative measurements of physical and mental health. In the three papers on family relationships and housing, current concepts are examined and numerous methods are suggested to test objectively the validity of present practices. There are five papers on free time problems and adjustments which describe the various efforts which are being made in different countries of Europe and the USA to cope with these difficulties.

Taken as a whole, this report is a valuable contribution to the literature providing new and stimulating ideas for studying the many social problems of old age.

WILLIAM HOBSON

NEW ILLUSTRATED MEDICAL ENCYCLOPEDIA FOR HOME USE—By Robert Rothensberg. (4 volumes boxed.) New York, N. Y.: Harry N. Abrams (6 West 57th St.), 1960. 1454 pp. Price, $50.00 for set.

Almost every conceivable medical subject, ranging from abscesses and adolescence to x-ray, is covered, all in the form of questions and answers. The questions are well phrased to bring out the information most important to a patient and his family. That the author

has availed himself of a competent group of contributors is evident from the authoritative and up-to-date answers provided.

The printing is in large easily readable type on good quality nonglare paper in an attractive binding which would be a decorative asset to any bookshelf. The four volumes measure about seven inches across. Numerous illustrations, some fairly technical, add to the usefulness of the work. These include an overlay anatomical chart which deserves special mention. Each volume has its own comprehensive index topped off by an over-all complete index at the end of Volume Four. The last volume also contains a useful section on definitions of medical terms.

In the opinion of this reviewer, the Encyclopedia would also be useful as a reference resource in any library serving paramedical personnel. Although the question and answer format may seem a little unprofessional, the stated purpose "for home use" might well be broadened. FLOYD M. FELDMANN

AN EXAMINATION OF THE CONCEPT OF PREVENTIVE MEDICINE—By Odin W. Anderson and George Rosen. New York, N. Y.: Health Information Foundation (420 Lexington Ave.), 1960. Series 12, 22 pp.

This monograph is a thoughtful review and realistic appraisal of the current concepts of preventive medicine. The authors point out that much of the thinking and planning related to preventive medicine programs is "Utopian" with some, but certainly not all, of the health objectives attainable.

There is a brief but informative presentation of prevention in the historical framework of medicine. Essentially the basic point is made that the incidence and prevalence of a disease exhibits a pattern characteristic for a specific population group relevant to its social and technical development and modified by the prevailing values of the people. The specific population group, Sweden, is used to illustrate the changing pattern of disease with a changing social and economic situation. The authors conclude that if all countries of the world were arranged in order of their present general mortality and infant mortality rates and by the prevailing causes of death, the resulting picture would virtually repeat the historical development of Sweden in these regards. A brief outline of the current concepts of preventive medicine includes good health habits, environmental sanitation, communicable disease control, health education and promotion, and health services for the individual. The question of what level of medical achievement can be expected is discussed and the problem of measuring "health" of a population is mentioned. Finally the limiting factors of how much health improvement can be expected for people or an individual in any time and place must be faced: "The biological stage of development of the individual, the inherent strengths in each stage which can be supported, the weaknesses that can be counteracted and finally, the absolute limit imposed by death."

The authors are to be commended for a sober review, analysis, and commentary on the current thinking in the field of preventive medicine. This report would be useful, informative, and interesting to students and workers in medicine and public health.

KURT W. DEUSCHLE

U.S.S.R. LITERATURE ON AIR POLLUTION AND RELATED OCCUPATIONAL DISEASES (Vol. 1)—A Survey by B. S. Levine. Washington, D. C.: U. S. Department of Commerce, Office of Technical Services, 1960. 210 pp. Price, $3.50.

Since most researchers and students of scientific problems in the United States are unable to make direct use of Russian publications, the Office of Tech-

nical Services, U. S. Department of Commerce, has undertaken a translation of segments of the Russian literature. This volume is the first in a contemplated series of survey reports. It has been prepared by B. S. Levine, Ph.D., under a U. S. Public Health Service research grant, and contains the translations of condensations of 38 volumes, reports, and articles. Many of the original documents have been translated completely by Dr. Levine. Volume 1 has been organized into three sections: General; Toxicity, Effect on Health and General Living Conditions; and Analytical.

ANNOTATED BIBLIOGRAPHY — THE OCCURRENCE AND BIOLOGICAL EFFECTS OF FLUORINE COMPOUNDS. VOL. 1: THE INORGANIC COMPOUNDS, BOOKS 1 AND 2—By Irene R. Campbell and Evelyn M. Widner. Cincinnati, Ohio: Kettering Laboratory, University of Cincinnati, Department of Preventive Medicine and Industrial Health, 1958. Price $25.00.

This bibliography is prepared for the use of researchers, investigators, and others interested in the subject of fluorine compounds.

Volume I deals with inorganic substances; almost 8,700 articles have been covered. Book 1 deals with articles having to do with the general discussion of fluorides, such as occurrence, physiologic and pharmacologic effects, and problems associated with pollution of air and water. Book 2 deals with articles having to do with the specific uses of fluorine plus legal aspects. Presumably there will be a volume II.

A STUDY OF COMPANY-SPONSORED FOUNDATIONS — By Frank M. Andrews. New York, N. Y.: Russell Sage Foundation (505 Park Ave.), 1960. 86 pp. Price, $1.50.

The company-sponsored foundation is a relatively new type of social institution on the American philanthropic scene. It is a tax-exempt and legally separate entity which is sponsored by a company, receives money from the company and from individuals closely associated with it, and is enjoined by the Internal Revenue Code to spend moneys received solely for religious, charitable, scientific, literary, or educational purposes.

This is a philanthropic area of considerable magnitude. In 1936, contributions made by companies—whether directly or through the vehicle of a company-sponsored foundation—amounted to 30 million dollars. By 1956, the figure was nearly one-half billion.

The present monograph reports a study of company philanthropy limited to the Chicago metropolitan area. It describes and analyzes the growth of company-sponsored foundations, their goals, patterns of administration, areas of philanthropic interest, and compares present and past planning methods and financial operations.

The volume is well written, tables are clearly presented, and the material is well organized. It will be of interest to would-be solicitors of company funds, as well as to students of social institutions.

DIRECTORY OF THE MEDICAL LIBRARY ASSOCIATION (2nd ed.) — Foreword by J. F. Fulton. Hamden, Conn.: Shoe String Press (965 Dixwell Ave.), 1959. 274 pp. Price, $7.00.

This handbook of the vital statistics of medical libraries will be invaluable not only to librarians, medical and otherwise, but also to any one concerned with medicine and public health who wants to know the library resources of his area and of other sections. The first edition of the "Directory" was published in 1950 and registered information about 360 member libraries. The present edition lists 560 libraries in the United States and other countries. The libraries are listed geographically, the name of library, address, name of librarian,

number of volumes, pamphlets, interlibrary loan privileges, special collections, and other pertinent data. There are also a list of members of the association and an index of libraries and special collections, by subject.

THE MATERIALS OF DEMOGRAPHY. A SELECTED AND ANNOTATED BIBLIOGRAPHY—By Hope T. Eldridge. Providence, R. I.: Population Association of America. Brown University, 1959. 222 pp. Price, $2.00.

This volume is designed to help meet the need of students, teachers, and investigators for a selective bibliography of demographic literature in English. The survey covers the literature published before 1958, but because of delays between compilation and publication, coverage of the more recent literature is incomplete.

The bibliography comprises ten sections covering the following subjects: general works in demography; population problems and theories; studies of specific populations; demographic analysis; fertility, marriage, and reproduction; mortality and morbidity; population distribution and migration; manpower and the labor force; legislative measures and population policies; and statistical compendia and bibliographies. A short introduction to each section explains its content and refers to relevant works in other parts of the bibliography. There is also an author index.

BOOKS RECEIVED

Listing in this column acknowledges the receipt of books and our appreciation to the senders. Space and the interests of readers will permit review of some, but not all, of the books listed.

ACTIVE ALERTED POSTURE. W. E. Tucker. Baltimore, Md.: Williams & Wilkins, 1960. 61 pp. Price, $3.00.

ADVENTURE TO MOTHERHOOD—The Picture-Story of Pregnancy and Childbirth. J. Allan Offen. New York, N. Y.: Taplinger, 1960. Price, $2.95.

AND THE POOR GET CHILDREN. Sex, Contraception, and Family Planning in the Working Class. Lee Rainwater. Chicago, Ill.: Quadrangle Books, 1960. 202 pp. Price, $3.95.

ANONYMOUS MYCOBACTERIA IN HUMAN DISEASE. Edited by John S. Chapman. Springfield, Ill.: Thomas, 1960, 173 pp. Price, $7.50.

ARTHRITIS AND FOLK MEDICINE. D. C. Jarvis. New York, N. Y.: Holt, Rinehart, and Winston, 1960. 179 pp. Price, $2.95.

BASIC READINGS IN SOCIAL SECURITY. 25th Anniversary of the Social Security Act 1935-1960. Washington, D. C.: Gov. Ptg. Office, 1960. 221 pp. Price, $1.00.

CANCER MORTALITY FOR SELECTED SITES IN 24 COUNTRIES (1950-1957). Mitsuo Segi. Sendai, Japan: Department of Public Health, Tohoku University, School of Medicine. 277 pp.

CLINICAL PROSPECT OF THE CANCER PROBLEM. D. W. Smithers. Baltimore, Md.: Williams & Wilkins, 1960. 232 pp. Price, $8.50.

COLD INJURY. Transactions of the Sixth Conference July 6-10, 1958. Steven M. Horvath, Editor. New York, N. Y.: Josiah Macy, Jr. Foundation, 1960. 375 pp. Price, $6.50.

COMMUNITY RESOURCES IN MENTAL HEALTH (No. 5). Reginald Robinson; David F. DeMarche; and Mildred K. Wagle. New York, N. Y.: Basic Books, 1960. 435 pp. Price, $8.50.

EFFECTIVE BOARD, THE. Cyril O. Houle. New York, N. Y.: Association Press, 1960. 174 pp. Price, $3.50.

ELEMENTARY TEACHERS GUIDE TO FREE CURRICULUM MATERIALS 1960. Randolph, Wis.: Educators Progress Service, 1960. 311 pp. Price, $7.50.

ENDEMIC GOITRE. WHO Monograph Series No. 44. New York, N. Y.: Columbia University Press, International Documents Service, 1960. 471 pp. Price, $8.00.

EVOLUTION OF MAN'S CAPACITY FOR CULTURE. J. N. Spuhler, et al. Detroit, Mich.: Wayne State University Press, 1959. 79 pp. Price, $3.50.

FAMILY PLANNING. J. F. Robinson. Baltimore, Md.: Williams & Wilkins, 1960. 64 pp. Price $1.25.

FOOD BECOMES YOU. Ruth Leverton. Ames, Iowa: Iowa State University Press, 1960. 198 pp. Price, $3.50.

GROUP PROCESSES. Transactions of the Fifth Conference, October 12-15, 1958. Bertram Schaffner, Editor. New York, N. Y.: Josiah Macy, Jr. Foundation, 1960. 196 pp. Price, $4.50.

HELP-BRINGERS: VERSATILE PHYSICIANS OF NEW JERSEY. Fred B. Rogers. New York, N. Y.: Vantage Press, 1960. 125 pp. Price, $2.95.

HUMAN TOXOPLASMOSIS (rev. 1959). Proceedings of the Conference on Clinical Aspects and Diagnostic Problems of Toxoplasmosis in Paediatrics. (The VIII International Congress of Paediatrics, Copenhagen, Denmark, 1956). Baltimore, Md.: Williams & Wilkins, 1960. 220 pp. Price, $12.50.

ILLUSIONS AND DELUSIONS OF THE SUPERNATURAL AND THE OCCULT. D. H. Rawcliffe. New York, N. Y.: Dover Publications, 1960. 551 pp. Price, $2.00.

LUPUS VULGARIS CUTIS IN DENMARK 1895-1954. Its relation to the epidemiology of other forms of tuberculosis. Ole Horwitz. Copenhagen, Denmark: Finsen Institute, 1960. 208 pp. Price, $6.50.

MENTAL DISEASE AMONG JEWS IN NEW YORK STATE. Benjamin Malzberg. New York, N. Y.: Intercontinental Medical Book Corp., 1960. 140 pp. Price, $3.75.

MULTILINGUAL MANUAL FOR MEDICAL INTERPRETING. Louis R. M. Del Guercio. New York, N. Y.: Pacific Printing Co., 1960. Price, $2.50.

NEGLECTED AREAS IN FAMILY LIVING. Thomas E. Sullenger. Boston, Mass.: Christopher Publishing House, 1960. 447 pp. Price, $5.00.

ORIGINS OF ALCOHOLISM. William McCord and Joan McCord. Stanford, Calif.: Stanford University Press, 1960. 193 pp. Price, $4.75.

PASSPORT TO PARADISE . . .? Bernard Finch. New York, N. Y.: Philosophical Library, 1960. 191 pp. Price, $6.00.

PATTERNS OF PROFESSIONAL EDUCATION. William J. McGlothlin. New York, N. Y.: Putnam's, 1960. 288 pp. Price, $6.75.

PLAGUE FIGHTERS. Herman Styler. Philadelphia, Pa.: Chilton, 1960. 126 pp. Price, $3.50.

PLASMA PROTEINS. Vol. 2—Biosynethesis, Metabolism, Alterations in Disease. Edited by Frank W. Putnam. New York, N. Y.: Academic Press, 1960. 518 pp. Price, $14.50.

PREPAYMENT FOR HOSPITAL CARE IN NEW YORK STATE. Ray E. Trussell. New York, N. Y.: State Insurance Department, 1960. 383 pp. Price, $5.00.

SELECTED BIBLIOGRAPHY OF CONTRACEPTION: 1940-1960. Edited by Christopher Tietze. New York, N. Y.: National Committee on Maternal Health, 1960. 76 pp. Price, $1.00.

SOCIAL SECURITY HANDBOOK—On Old-Age Survivors and Disability Insurance. Washington, D. C.: Gov. Ptg. Office, 1960. 261 pp. Price, $.75.

STATESMAN'S YEAR-BOOK 1960-1961. Statistical and Historical Annual of the States of the World 1960-1961. Edited by S. H. Steinberg. New York, N. Y.: St. Martin's Press.

STEPS IN THE DEVELOPMENT OF INTEGRATED PSYCHIATRIC SERVICES. New York, N. Y.: Milbank Memorial Fund, 1960. 146 pp. Price, $1.00.

SWIMMING POOL OPERATION—A Manual for Operators. Seattle, Wash.: Washington State Public Health Association, 1960. 75 pp. Price, $1.25.

TAKEN AT THE FLOOD—The Story of Albert D. Lasker. John Gunther. New York, N. Y.: Harper, 1960. 368 pp. Price, $5.00.

TEACHING THE MENTALLY RETARDED CHILD. Natalie Perry. New York, N. Y.: Columbia University Press, 1960. 282 pp. Price, $6.00.

A SELECTED PUBLIC HEALTH BIBLIOGRAPHY WITH ANNOTATIONS

Raymond S. Patterson, Ph.D., F.A.P.H.A.

Climate and MS—A study was made of 1,782 veterans with multiple sclerosis. When the cases were distributed by (state) birthplace it was seen that the incidence became progressively greater from south to north, all across the country, and this was true regardless of color. There were more cases than would be expected among those born in Canada and fewer among those from the Caribbean.

ACHESON, E. D., AND BACHRACH, C. A. The Distribution of Multiple Sclerosis in U. S. Veterans by Birthplace. Am. J. Hyg. 72,1:8 (July), 1960.

Measles Is Dangerous—In this series of eight papers, it is made clear that attenuated measles virus vaccine is easily administered, causes no local reaction, and the result is not communicable, though the index of serologic response is high. It is a safe prophylactic against a sometimes dangerous disease; however, occasional fevers and rashes occur (resembling more closely globulin modified attacks than natural disease). Further clinical trials are suggested for special groups while laboratory studies will be continued to improve the vaccine.

ENDERS, J. F., et al. Studies on an Attenuated Measles-Virus Vaccine. New England J. Med. 263,4:153 (July 28), 1960.

Grim Finding—In this year-long study of hospital-acquired staph infections the greatest number were in patients in their sixth decade of life and the greater proportion among males. High rates were recorded among patients with diabetes, fractures, and neoplasms (four out of five being in chronic patients with one disease or another). Almost a tenth of all hospital deaths were associated with staphylococcal disease.

FARBER, S. M., AND MACLEOD, C. M. Staphylococcal Infections in a University Hospital. Am. J. Hyg. 72,1:38 (July), 1960.

Not What They Seem—Penicillin-resistant gonococci have occasionally been named as the great new threat to the control of gonorrhea. This report presents evidence that there are penicillin-resistant organisms sometimes isolated from the genitourinary tract that mimic the gonococcus, but can be differentiated from it by more exact laboratory procedures. Penicillin in adequate doses is still the best treatment for gonorrheal urethritis, say the authors.

GANGAROSA, E. J., AND CARY, S. G. Validity of Reports of Penicillin-Resistant Gonococci. J.A.M.A. 173,16:1808 (Aug. 20), 1960.

There Might Be Time—Not because you are a public health person but because you are a responsible U. S. citizen, this introduction to a series of papers on civil defense is urgently forced upon your attention. It answers convincingly all the often-repeated assertions about the futility of doing anything toward protecting ourselves from the effects of nuclear warfare. You may not want to read the grim portrayal, but every single one of us should expose himself to this reminder of the dire possibilities.

GABE, S. Survival in a Thermonuclear War. New York State J. Med. 60,15:2440 (Aug. 1), 1960.

Planners at Work—Most of us, no matter where our immediate interests may lie, must be aware of the country's sharpening water supply deficiencies. Here are two forward-looking papers that point to the more pressing problems to be met in the next two decades. It is not so much a matter of the total amount of available water as it is the growing contamination of our river systems and getting water to the places it will be needed that furrows the brows of our national planners. Both papers are commended to your attention.

HOLLIS, M. D. Pollution and National Water Resources (and) SCHAD, T. M. Activities of the Senate Select Committee on National Water Resources. J. Am. Water Works A. 52,8:959 (Aug.), 1960.

Precious Teeth—In Oregon a dependent child (under 15) of a member of a certain union may receive essential dental care from a dentist of his parent's choice and the bill will be paid out of a union fund. There are 2,285 children covered and the average annual payment per child is $28. It is said that the dentists approve the plan and would be willing to work with other unions under similar terms.

HOWARD, W. W. Effects of the ILWU-PMA Dental Program on Private Practice in Oregon. J. Am. Dent. A. 61,2:166 (Aug.), 1960.

Flower of American Youth—During the Korean War only about three of every four men called in the draft (ages 18-26) managed to qualify for service. In addition to the 24 per cent immediately disqualified for physical or mental disabilities another 6 per cent were gathered in but placed in category "C"—below functional efficiency.

KARPINOS, B. D. Fitness of American Youth for Military Service. Milbank Mem. Fund Quart. 38,3:213 (July), 1960.

Brass Tacks Department—"It is undeniable that (hospital) physicians and nurses are much less conscious today about the need for cleanliness than they were thirty years ago" says the author of the first of five papers on keeping hospitals really clean and, incidentally, helping control the spread of staphylococcus infections. These how-to-do-it papers must be of interest to many outside—as well as in—hospitals.

LETOURNEAU, C. U. Progress in Hospital Sanitation (and four related papers). Modern San. 12:8 (Aug.), 1960, pp. 13–16 and 53.

If There's a Will—A county medical society appointed a working committee which really went to work at a variety of things such as polio prophylaxis, psychiatric help for general physicians, effective health guidance for patients, and forums with broad publicity features.

LICHTMAN, H. S. AND PODAIR, S. Public Health Activities of a County Medical Society. J.A.M.A. 173,13:1454 (July 30), 1960.

Interesting Question—Why are birth rates unusually high in the late summer and at the lowest in the spring? In Baltimore the least favored economic groups reveal the greatest seasonal swings, whereas the upper crusts account for little seasonal variation. Climate, nutrition, and other possible factors receive brief speculative mention.

PASAMANICK, B., et al. Socio-Economic and Seasonal Variations in Birth Rates. Milbank Mem. Fund Quart. 38,3:248 (July), 1960.

Rapid Mass Immunization—It seems that in areas where unhygienic conditions permit wide dissemination of polio and other enteric viruses, single doses of poliovirus vaccine do not produce the anticipated protection that healthier regions have produced. So a new schedule of vaccinations is proposed for the unsanitary regions—where most of the world's people are forced to live.

SABIN, A. B., et al. Live, Orally Given Poliovirus Vaccine. J.A.M.A. 173,14:1521 (Aug. 6), 1960.

Nutrition for Export—Though it may seem distant from your professional preoccupations, you may still want to know about what the Interdepartmental Committee on Nutrition for National Defense is doing to help some foreign countries assess their need for nutritional health services and to improve those they may have. U. S. teams have helped out in matters of nutrition, medicine, agriculture, food technology and biochemistry, working side-by-side with specialists of the 12 countries so far surveyed.

SCHAEFER, A. E., AND BERRY, F. B. U. S. Interest in World Nutrition (and four related papers). Pub. Health Rep. 75,8:677 (Aug.), 1960.

BCG'S and BCG's—Maybe you should know about this laboratory study which reveals that all BCG's are not antigenically alike. Here is the last of the conclusions: "The highest degree of protection presented comes from the use of the attenuated human strain R_1. Fairly close to this stand BCG No. 3 and No. 4. Other BCG strains studied fall far below this and exert little or no effect upon the course of infection following challenge."

WILLIS, H. S., et al. Studies in Tuberculo-Immunity. Am. J. M. Sc. 240,2:137 (Aug.), 1960.

In Praise of Exercise—Too often, says this reviewer, exercise is dismissed as of little or no importance in weight reduction plans. The more one exercises the more one eats, argue the dismissers. This just isn't true, asserts this author, who reminds us that moderate and consistent exercise is better all around than going semihungry much of the time.

YOUNG, C. M. Exercise and Weight. New York State J. Med. 60,15:2449. (Aug. 1), 1960.

If additional information is desired regarding the articles listed in this bibliography, please communicate directly with the publications in which they appeared; the addresses are furnished for your convenience.

Am. J. Hyg. (American Journal of Hygiene), 615 N. Wolfe St., Baltimore 5, Md.

Am. J. M. Sc. (American Journal of the Medical Sciences), Lea and Febiger, 600 Washington Square, Philadelphia, Pa.

J. Am. Dent. A. (Journal of the American Dental Association), 222 N. Superior St., Chicago, Ill.

J.A.M.A. (Journal of the American Medical Association), 535 N. Dearborn St., Chicago, Ill.

J. Am. Water Works A. (Journal of the American Water Works Association), 2 Park Ave., New York 16, N. Y.

Milbank Mem. Fund Quart. (Milbank Memorial Fund Quarterly), 40 Wall St., New York, N. Y.

Modern San. (Modern Sanitation), Power Magazines, Inc., 855 Avenue of the Americas, New York 1, N. Y.

New England J. Med. (New England Journal of Medicine), Massachusetts Medical Society, 8 The Fenway, Boston 15, Mass.

New York State J. Med. (New York State Journal of Medicine), 750 Third Ave., New York, N. Y.

Pub. Health Rep. (Public Health Reports). Government Printing Office, Washington, D. C.

CREDIT LINES

The Journal cannot furnish copies of items mentioned in Credit Lines. Please send requests to addresses given.

Attending a Congress in Absentia

By rough estimate 250 entries appear in "Abstracts: Thirteenth International Congress on Occupational Health," published in July when the congress met in New York City. Each entry, however, is printed four times: in English, French, German, and Spanish. The flavor of internationality and a sample of subjects is seen from a glimpse at a few pages only in the English section: "The Environment and Ecology of the Nuclear Submarine" by John Ebersole, USA; "Nonoccupational Asbestosis" by R. Kiviluoto, Finland; "Treatment of Progressive Massive Fibrosis in Coal Miners," R. I. McCallum, Great Britain; "The Diffuse Sclerotic Form of Silicosis," by P. P. Dvizhkov, USSR; "Occupational Toxic Anemia," Juko Kubota, Japan, and so on.

This substantial tome of 569 pages is an excellent second best for those unable to attend the congress, and is available for $4 through Robert E. Eckardt, M.D., secretary-general, 13th International Congress on Occupational Health, P. O. Box 45, Linden, N. J. Chairman of the organizing committee for the congress was Leo Wade, M.D., ESSO Standard Oil Co., New York City.

Boning Up on the Entire Department

" 'Where can I get my yellow fever vaccination?' a citizen asked an employee of the Dallas City Health Department. The answer was: 'Go to the U. S. Public Health Service.' Taking the employee at his word the citizen (and taxpayer, as he later made certain to inform us) took time off from his busy schedule to go to the U. S. Public Health Service where he was told that the only place he could get yellow fever vaccination was at the Dallas City Health Department." Quotes from the opening gambit in a report made by the department.

This and other instances of lack of information upon the part of City Health Department employees about department activities other than their own led to the initiation of an inservice training program for stimulating better intra- and extradepartmental communication.

The plans for carrying out this program and an evaluation of the inservice training which resulted are set forth in the report (four pages, mimeographed) available free. Write J. C. Armstrong, Director, Public Health Education, City Health Department, Dallas, Tex.

An Aid to the Practicing Engineer

The Sanitary Engineering Division, American Society of Civil Engineers, and the Water Pollution Control Federation have joined forces to produce "Design and Construction of Sanitary and Storm Sewers." This 12-chapter manual of practice, well illustrated, covers such subjects as project planning, investigations, hydraulics design, and construction materials and methods —a valuable reference in this important phase of waste water technology. American Society of Civil Engineers, 33 West 39th Street, New York 18, N. Y., or Water Pollution Control Federation, 4435 Wisconsin Avenue, Washington 16, D. C. $7 to nonmembers and $3.50 to members of either organization.

The Willing and Unwilling

"Cooperation in Health Examination Surveys," in the series on "Health Statistics from the U. S. National Health Survey," is an analysis of answers to one of the questions asked of respondents in household interviews conducted by the National Health Survey. Respondents were asked, "If you are selected for this special free examination and the time and place are convenient, will you be willing to come?"

In the total sample, of every 12 respondents, eight said yes, three said no, and one was not sure. However, there were regional, residential, and other differences. People from the South and West were more willing than those from the Northeast and North Central regions; residents of rural areas were more favorable than urbanites; persons aged 18-44 were more willing than those 45-64, while those 65 and over were least willing; nonwhites were more cooperative than whites; women slightly more positive than men; people in the middle income range were more willing than those in either the lower or higher brackets; persons with high school or less education were slightly more favorably disposed than those with college backgrounds; individuals who had visited physicians more recently were more amenable than those who had not visited a physician in some time; and persons with chronic conditions tended to be more favorable than those without.

This 38-page monograph provides information only on expressed willingness or unwillingness to accept a health examination for survey purposes. The degree of consistency between such expressions and actual behavior is outside the scope of the study. However, one might hope that a subsequent report would address the latter problem. Available as PHS Publication No. 584-D2, Government Printing Office, Washington 25, D. C.; 35 cents.

Fluoroscopy for a Frontrunner

"Maryland has developed over the years some excellent medical programs. They are well administered and provide good care." This is taken from Chapter One, Summary of Major Findings and Recommendations in "Administering Health Services in Maryland," —a report of a subcommittee on policies and financing of medical and hospital programs of the Committee on Medical Care, Maryland State Planning Commission.

Frontrunners like Maryland and its medical care programs get to be pacesetters by arduous training and periodic examination from the outside looking in. This report is characteristic of the regimen that keeps that state's organized health services in trim.

"The great need now," the report continues, "is for a more flexible system, a system which will facilitate changes required by community needs and advances in medical research. . . . The institution should be but one episode in the programmed care of hospital patients. . . . For this orientation to be successful, however, adequate community support services must be developed. . . . The hospitals in Maryland are properly oriented." However, there is a "lack of integrated support facilities and services . . . (forcing) patients to stay in the hospitals beyond the time which is medically necessary." This is not only costly and an inefficient use of scarce personnel and facilities, but, "more important, has made patients dependent on the hospitals . . . social cripples."

The data and findings in the 152-page report set forth the need for this "greater flexiblity." The subcommittee's recommendations for meeting this need center on a patient-oriented system, the essence of which is the "Case Formula" to finance preventive and treatment services. Discussion of the mechanics for implementing the system, however,

does not overshadow the basic aim of the report—improved medical care.

Available as Publication No. 108, State Planning Department, 1103 State Office Building, Baltimore 1, Md. $1.

(EDITOR'S NOTE: Received too late for review in this issue is another document from the State Planning Commission's Committee on Medical Care: "Report of the Subcommittee on Organization for Health." In three chapters, the second being devoted to "Six Guide Lines to Public Health." Available from the above address for 50 cents.)

Communicable Diseases on Film

Wayne State University College of Medicine has produced a sound-color motion picture (16 mm, 30 min.) on "the Physical Diagnosis of Communicable Disease." Over 20 cases are presented covering the common communicable diseases and a few of the rarer ones: Roseola infantum; German measles (a mild case showing the rash and postauricular adenopathy followed by a more profound case which is differentiated from scarlet fever); Measles; Chicken Pox; Mumps; and Cervical Adenitis (the method of differentiating these diseases is shown); Scarlet Fever; Whooping Cough; Meningitis (several patients with different types are seen; the rash of meningosoccemia is shown); Herpes simplex; Herpetic stomatitis; Fungus stomatitis; Herpes Zoster; Viral encephalitis (a patient with the characteristic shriek, facies, and behavior is seen); Acute poliomyelitis; Tuberculosis (a disseminated case showing extensive involvement of skin, glands, and bone; a markedly positive tuberculin reaction is presented); Mycotic infection.

The film may be requested from the Audio-Visual Utilization Center, Wayne State University, Detroit, Mich. For departments which will have repeated use for the film, prints will be available at cost. The film will also be available for single showings on a service charge basis. Frederick J. Margolis, M.D., is director of audiovisual education at the medical school.

Candid Camera: A Self-Portrait

The Planning Committee of the Nebraska State Board of Health has prepared a report, with recommendations, on the present scope of activities of the Nebraska Department of Health. The committee's work appears to have been very thorough, and its recommendations framed consistently in keeping with their statement in the report's introduction: The accelerating rate of new achievements and advances in health knowledge "places upon the Department of Health serious responsibilities in minimizing the gap between new knowledge and its application."

The Planning Committee gathered its material by asking the director of each division to make an analysis of the duties and accomplishments of his division and of the frustrations it had encountered in the past years. The committee also requested that the directors evaluate employee morale. Finally, each was asked to frame the objectives of his division in terms of narrowing the gap between knowledge and its application.

As might be expected proposals for departmental reorganization have resulted. Among other results, the committee has been able to highlight the gaps that exist between not quite so new knowledge and its application. For example, although cancer was the state's second leading cause of mortality in 1958, no morbidity data are available on its incidence. It is not a reportable disease in the state nor does a cancer register exist. Also "limited cooperation exists between the State Department of Health and all voluntary and official agencies in Nebraska."

The committee, drawing on the thinking of the State Health Department staff, has reported in statesman-like

fashion and many readers in many parts of the country who avail themselves of the document will undoubtedly feel in its debt for expressing so candidly what undoubtedly needs to be said in many bailiwicks of public health practice.

This report and "A Joint Review of the Nebraska Department of Health" conducted by representatives of the Public Health Service and the Children's Bureau, Region VI, are available upon request from E. A. Rogers, M.D., M.P.H., director of health, Nebraska Department of Health, Capitol Building, Lincoln. The Joint Review is also a thorough examination of the problems being faced and resolved by the state's official health agency. Both documents were released in July. The Joint Review contains comments on the fly leaf in the form of recommendations by the State Board of Health based on the study results. Among these: "That a State Health Advisory Council be appointed. The Nebraska Public Health Association has a wide membership that might well serve as a nucleus of this advisory council."

Aids for Saving Neighborhoods

The Urban Renewal Administration, Housing and Home Finance Agency, has two kits available, on a limited basis, for the use of officials and others actively involved in urban renewal. "Rehabilitation Kit No. 1" includes materials on neighborhod analyses, selection of areas for conservation and rehabilitation, qualifications for Title 1 Assistance, standards for rehabilitation of dwellings, neighborhood organization, and eligible costs for neighborhood organization. No. 2 supplies information on building surveys, surveys of family preferences and financial capabilities, eligible costs for surveys, implementing rehabilitation, financing aids in the 1959 Housing Act, use of FHA Section 221 mortgage insurance, and case histories. Additional kits are planned. Address Leonard J. Czarniecki, Director, Rehabilitation & Conservation Branch, URA, 811 Vermont Avenue, N.W.; Washington 25, D. C.

Glaucoma Program Guide

The Bureau of Chronic Diseases and Geriatrics, New York State Department of Health, has prepared a 39-page "Glaucoma Program Guide" to help local health officers and community groups interested in developing effective controls for sight conservation.

Emphasis in this guide is on early discovery through permanent glaucoma detection centers. By sections, the manual treats of glaucoma as a disease and as a public health problem, of the components of the program, and of community resources. Appendixes include sample news releases, radio and TV announcements, and a bibliography. Drawings in color of the anatomy of the eye are by courtesy of Lederle Laboratories.

For information on the guide's availability outside New York State write Health Education Service, P. O. Box 7283, Capitol Station, Albany 1, N. Y.

Recent Federal Publications

Unless otherwise noted, the following are available through the U. S. Government Printing Office, Washington 25, D. C.

"Selected Articles on Nursing Homes," (PHS Publication No. 732, 287 pages, $1.50) has been compiled "primarily to assist interested state and local agency personnel." But Wilfred D. David, medical director, chief, Chronic Disease Program, Division of Special Health Services, expresses hope in the foreword that it will "also be helpful to other individuals and groups." Forty-seven reprints (from a variety of periodicals,

including A.J.P.H., and by a stellar cast of authors), a directory of state licensing agencies, and selected special references make this a comprehensive library on the topic.

"Accident Prevention—a Handbook for Public Health Nurses," may be obtained, free of charge, by writing Public Health Service, Division of Special Health Services, Accident Prevention Program, Washington 25, D. C. (PHS Publication No. 670, 55 pages, 25 cents through the Government Printing Office). Sampling the booklet's topics: philosophy of safety, epidemiology of accidents, and specifics for public health nurses in accident prevention. Contains tables and charts of accidental deaths and accidental injuries by age groups and types of accidents, and listings of resource materials.

"Homemaker Services in the United States" is a comprehensive report growing out of the National Conference on Homemaker Services held in Chicago, February, 1959. It has been issued as PHS Publication No. 746 (257 pages, $1.25). Chapters treat with on the origin and development of homemaker services; homemaker programs and health services; local and state-wide planning; personnel policies; financing; and studies and promotion of homemaker services at the national, state, and local levels. Major papers at the conference are included. Edward Press, M.D., then field director, APHA, represented the Association at the conference.

"Highlights of Progress in Mental Health Research, 1959" (PHS Publication No. 736, 51 pages, 25 cents) treats with selected studies carried on by NIMH scientists and grantees last year and describes significant program developments. Covers 15 areas of research, including biochemistry, psychopharmacology, the search for pathology, mental illness and family relations, and community mental health services.

"Public Health Service Film Catalog: June, 1960" is now available as PHS Publication No. 776, 50 cents. Films and filmstrip titles are arranged in subject groups, alphabetically, and in cross-indexes. All listings were made for, by, or in cooperation with PHS. Some are for the general public while "others may be used interchangeably by the health professions and lay audiences." The majority, however, are technical. This document will bring one up to date; to be kept up to date, one's name may be placed on the mailing list for announcements of newly released films by writing Audiovisual, Communicable Disease Center, Atlanta 2, Ga.

"Maternity Benefit Provisions for Employed Women" (Department of Labor, Women's Bureau Bulletin 272, 50 pages, 25 cents) notes that "in these days, when one woman in three contributes to the national economy through her employment, and more than half of all women workers are married," such benefits are a matter of vital importance. The booklet describes the various maternity leave, compensation, and medical and surgical benefits provided for employed women covered by voluntary benefit, union-management, and government plans. Appears to cover the topic thoroughly and should be a useful guide for medical care and public health administrators. But specialists and generalists alike may find "International Standards for Maternity Protection" the most interesting of all. This, the final section of the booklet, helps put the whole document into perspective.

"Control of the Physical Environment" (U. S. Department of Labor, Bureau of Labor Standards, Bulletin No. 211, 13 pages, 15 cents) is the first of a series on "Safety in Industry."

It discusses hazards created by the physical environment and suggests measures to eliminate or diminish them. Written in nontechnical language, it is intended for use as a management guide for assessing hazard in facilities, materials and processes. While the supply lasts, single copies free from the bureau, Washington 25, D. C.

"Radiological Health Data" will report monthly on levels of radioactivity in the environment. Included in the first issue (April, 1960) are data covering the occurrence of strontium-90 in milk collected during November, 1959, at 12 locations in the United States, in milk collected during the same month at three locations by the Atomic Energy Commission, in monthly milk collections for the year ended with August, 1959, at six locations in Minnesota; also information on radioactivity in air samples collected at 44 points in the United States during November and in 12 Latin American and six United States points along the 80th meridian; and data on radioactivity in surface water samples collected during October, 1959, at 61 points in the United States. Single copies, 50 cents; six-month subscription, $3. From Office of Technical Services, Department of Commerce, Washington 25, D. C.

Scholarship Is a Profession

"In this it resembles law, medicine, museum works, acting, personnel management, the ministry and other vocations. Its point of view is as essential to the total national picture as is the point of view of any other profession from that of war to that of the ministry. To infer or assume, as some have done, that scholarship is an escape from reality into a sort of never-never land is an inexcusable error. Scholarship is not an escape from reality; it is a part of reality, it is reality, since, if there were no scholarship, it would be hard to think of us as a nation. There would be no art museums, libraries, theaters, parks, or holidays, just as there would be no formal religion, no laws, and no courts. Without scholarship, there is no history, and no tradition, and no notion of the meaning of words like 'justice,' 'right,' 'fair practice,' 'contract,' 'beauty,' 'the Christian tradition,' 'authority,' or 'the United States.'"

Howard Numford Jones. One Great Society. Harcourt, Brace and Company, New York, 1959.

NEWS FROM THE FIELD

WHO News

Assessment of Radiation Risk

Ways in which statistical records can be used more effectively by biologists to assess the effects of atomic radiation on human life have been explored at an international seminar on the Use of Vital and Health Statistics for Genetic and Radiation Studies, held in Geneva, September 5-9 under WHO auspices.

At the seminar geneticists and epidemiologists met with civil registrars and vital and health statisticians to study the kinds of information needed and the practical possibilities of gathering data. According to seminar planners any assessment of the risks of radiation exposure requires extensive information relating both to irradiated individuals and to nonirradiated persons. It has been found that at least part of the needed information lies buried in vital and health statistical records, such as birth and death certificates, marriage certificates, and census returns, which most countries accumulate on every individual.

Approximately 60 experts were invited to the seminar from more than 18 countries. Twenty-one papers were given at the seminar. Proceedings will be published. Chairman was Curt Stern, Ph.D., professor, Department of Zoology, University of California, Berkeley.

Health Services for the Congo

Nineteen medical and health teams with a total of 121 staff members, provided by Red Cross and Red Crescent societies or by governments, are in the Republic of the Congo for aid in the United Nations Civilian Operation there.

Their work is being coordinated by WHO, which has the responsibility for the health activities of the UN operation. WHO is also being used by the new Congo government as its advisory body in health matters.

At the end of the first month of health operations, James S. McKenzie Pollock, M.D., the WHO representative in the Congo, commented that, although placement of medical teams had been difficult at first because of the uncertainty of security, "there is every sign that the situation is rapidly improving."

The Latest Report on VD

The WHO Expert Committee on Venereal Infections and Treponematoses in a Fifth Report views its subject in terms of the simplified therapy now available, the need for more accurate reporting, and the development of international serological standards and methods. The present status of treatment for the main venereal infections is reviewed and methods of achieving eradication of endemic treponematoses are discussed. The report also takes a close look at the question of the increased risk of allergic reactions to penicillin and their prevention at the public health and patient levels. The committee places special emphasis on the importance of planning research, and makes suggestions for the exchange of scientific information, for the establishment of a standard nomenclature and classification of yaws and syphilis, for training of auxiliary personnel and their teachers in preparation for mass campaigns, and for the furnishing of venereal disease information and health education to age-groups at particular risk of infection.

WHO Technical Report Series, 1960, No. 190; 73 pages, $1. Also in French and Spanish.

After Benefits Run Out, What?

The Bureau of Public Health Economics of the University of Michigan School of Public Health has launched a three-year study of California's state disability insurance program.

In the first stage of the study researchers will examine the worker's problems when his disability payments are discontinued after 26 weeks (the maximum coverage). They will explore the type of medical care he receives during the period of disability, his source of supplementary aid, and the level of employment to which he returns. This phase of the work is sponsored by a grant from the Office of Vocational Rehabilitation.

In the second phase of their work the investigators will make an over-all study of California's disability insurance program with particular attention to fiscal policies, medical features, and administration. Evidence will be sought on the relationship between the disability program and benefits from Workmen's Compensation, hospital insurance, and the disability provisions of federal Old Age and Survivor's Insurance.

California, New York, New Jersey, and Rhode Island are the only states in the nation which provide a state-wide disability insurance program. Over three and a half million Californians contribute up to $36 each, per year, for this protection.

Nathan Sinai, Dr.P.H., is principal investigator of the study which will be carried out in cooperation with the California State Department of Employment Security in Sacramento.

Mental Health Via the Family

The Family Institute is a new national organization to combat and treat mental illness on a family rather than on an individual basis, and "to evolve a comprehensive program for the enhancement of the mental health of families through research, diagnostic and educational activities." Chairman of the new organization is Nathan W. Ackerman, M.D., associate clinical professor of psychiatry at Columbia University College of Physicians and Surgeons, New York City. Family Institute will offer program assistance to more than 600 family agencies and counseling centers throughout the country. The institute plans to establish a training program in the technics of family psychotherapy for psychiatrists and members of the other professions concerned with mental health; initiate Family Mental Health Clinics in such places as hospitals and family agencies; sponsor an annual meeting; publish a professional journal; and promote and engage in research.

Anne W. Langman is president. Directors of the institute include Martin Cherkasky, M.D., New York City; Iago Galdston, M.D., New York City; Roy R. Grinker, M.D., Chicago, Ill.; and Donald D. Jackson, M.D., Palo Alto, Calif. Mrs. Richard W. Dammann is executive director with offices at 10 East 44th St., New York 17, N. Y.

Responsibilities for Health Services

The Industrial Council for Tropical Health held its Fourth Conference July 20-22 at the Harvard School of Public Health. The school sponsors these conferences (1950, 1954, 1957) which are devoted to the exchange of ideas and information on improving the health of people living and working in the countries in which the participating industrial firms have established operations. Eighty-two delegates from 58 firms, 15 nonindustrial experts in the field of tropical public health, and 28 members of the Harvard faculty participated.

General topics for the conference sessions were: the Responsibilities for

Health Services in Developing Areas, Schistosomiasis, Trachoma, Poliomyelitis, Tropical Eosinophilia, Control of Insects, and Viruses of Current Importance in the Tropics.

The session on health services was chaired by Ralph F. Schneider, M.D., medical director, Standard Oil Company (N. J.).

Mr. Siro Vazquez, producing coordinator, Standard Oil Company (N. J.) spoke on the role of industry. One of the points he made was that in underdeveloped areas where an industrial operation begins, management has an interest in providing any medical services that are needed in the area in addition to typical occupational health services. This is done preferably by encouraging any existing local facilities and personnel to expand and improve, and by cooperating with official agencies to help establish public health services and facilities. When community facilities are nonexistent industry must often set up and operate services on a term basis with the expectation that they will eventually become community-administered.

Henry van Zile Hyde, M.D., Assistant to the Surgeon General for International Health, PHS, set forth the responsibilities of government. In developed societies, he pointed out, one problem is to avoid undue encroachment on private enterprise and displacement of local agencies by massive federal intervention. The underdeveloped countries are all keenly conscious of the need for promoting national health, but in the absence of sound logical guides often make decisions on the basis of political expediency. Aid to these countries through WHO, he said, should preferably take the form of technical assistance, provision of capital and technical exchange.

Rudolph Faupl, international representative, International Association of Machinists, reported on labor's interest and responsibility. Mr. Faupl, also the United States workers' delegate to the International Labor Organization, described ILO's recently adopted objectives for health services that will protect workers against occupational health hazards and contribute towards the highest possible degree of physical and mental well-being of employees. One recommendation calls for the organization of occupational health services in places of employment with either a separate service within a single undertaking or a service which would be common to a number of undertakings. Labor's objectives: to educate the worker to recognize and protect himself from hazards; to educate the physician in the proper methods of approaching workers; and finally to educate community leaders in the role of the community itself.

The responsibilities of local communities were set forth by Edmund D. Pellegrino, M.D., chairman, Department of Medicine, University of Kentucky Medical Center, formerly medical director, Hunterdon Medical Center, Flemington, N. J. In some underdeveloped areas, he said, the only community hospital is one that is operated and staffed by the government. In other areas, the hospital serving workmen is operated and staffed through the social security system. In many European countries, local hospitals have staffs who practice exclusively within the hospital. A similar situation exists where hospitals formerly operated by industry have become community hospitals with a private professional staff supplying inpatient services.

Under circumstances such as this, it is of utmost importance for physicians supplying occupational health services, for physicians acting as generalists to the family and the community, and for physicians supplying services exclusively within the hospital to understand each other's scope and responsi-

bilities and to coordinate their efforts for the greatest benefit of the patient and the community.

Dr. Schneider, the session chairman, represented the beneficiary of services and described what he believed the patient's responsibilities to be in relation to health services: Intelligent use of services provided to fulfill the obligation of maintaining himself in optimal health for his own, his family's and the public's benefit.

In a summarization of the session, Dr. Schneider said it was apparent that "technological developments in medicine, specializations in the branches of medicine and the diversification of medical care make it impossible for any one medical entity to provide by itself alone the entire medical needs for a community. However, a high quality of medical service in all fields is both desirable and possible through a proper understanding of the defined scope and responsibilities of all health services—which, in turn, would promote the necessary degree of coordination and cooperation to provide for the most good of the individual, the community and the nation."

Emergency Care for Indigents

Twenty-two accredited hospitals in the Philadelphia area have signed contracts with the municipal Philadelphia General Hospital to provide care in the Emergency Medical Service Program to indigent residents. This program is the result of recommendations made by the city's Community Policy Committee on Health and Hospital Services.

Contracts became effective July 15. The City Council has appropriated $500,000 to reimburse the participating hospitals plus $14,000 for personnel and material costs. Under terms of the contracts, the city will reimburse hospitals at the rate of $5.23 per emergency care visit. Payment shall be made for free patients who are bonafide residents of Philadelphia. Reimbursement shall be for actual cases treated and shall not exceed the maximum in each contract. Maximums were determined according to the numbers of free patients treated at the participating hospitals in 1959.

Leonard J. Zimet, medical program analyst at Philadelphia General Hospital, will direct the program.

"The Thread of Life"

This is the title of an hour-long television program—"colorcast"—which the Bell System Science Series will present over NBC-TV nation-wide on Friday evening, December 9. It will tell the story of the most important discoveries in genetics during the past 100 years. Dr. Harriet Ephrussi-Taylor will appear as a guest on the program to demonstrate experiments with deoxyribonucleic acid (DNA), and Drs. Andrzej and Jadwiga Bajer will show how they made their stop-motion photomicrographs of the process of mitosis. Live action, documentary film, animated diagrams, charts, and models will be used to explain other aspects of genetics.

Like the other six programs in the Bell System Science Series, "The Thread of Life" will be available without charge on 16-mm color film for group showings after the December 9 telecast, upon request to local Bell Telephone companies.

Dental Management in Heart Disease

For the first time, a program for dentists will be included in the American Heart Association's annual Scientific Sessions, to be held this year in St. Louis. Sponsored jointly with the American Dental Association, the program is scheduled for the opening day, October 21. It will take the form of a symposium on Management of Medi-

cal-Dental Problems in Patients with Cardiovascular Diseases. Among the subjects to be discussed are "The Nature of Restorative, Periodontal, and Oral Surgical Dental Services," "Prophylactic Use of Antibiotics in Patients Who Require Dental Manipulative Procedures," and the use of local anesthetics during dental procedures in patients who are receiving anticoagulant, antihypertensive, and diuretic drugs for treatment of cardiovascular conditions. Advance registration forms from Membership Department, American Heart Association, 44 East 23rd St., New York 10, N. Y.

Mobilizing Follow-up Care Services

Staff at the Duke University Medical Center, Durham, N. C., is exploring a proposal for setting up an Institute on Continued Patient Care. If established the institute would provide an educational program for workers in various health fields to help them mobilize and coordinate the health services which are available to patients after their discharge from hospitals. Among the persons invited to evaluate this proposal for organizing follow-up care are J. W. R. Norton, M.D., secretary and state health director, North Carolina State Board of Health; Ellen Winston, Ph.D., head of the North Carolina Department of Public Welfare; and Amos N. Johnson, M.D., president, North Carolina Medical Society.

Proposals for Patient Safety

The Food and Drug Administration has proposed stronger regulations to insure that physicians receive adequate information about the drugs they prescribe and to insure the safety of new drugs. The new regulations would:

1. Require definitive labeling changes for prescription drugs. Drug packages and printed matter distributed to physicians in sales promotions would be required to bear complete information for professional use of the drug, and precautions on any hazards and side effects. The only exception would be frequently used medicines that are commonly familar to the doctor.

2. Provide that when safety requires, a new drug would be kept off the market until the manufacturer's representations regarding the reliability of manufacturing methods, facilities, and controls have been confirmed by a factory inspection by the Food and Drug Administration.

Commenting on these and others of the regulations at the time they were proposed, George P. Larrick, commissioner of foods and drugs, said: "The large number of new medications has made it increasingly difficult for doctors and pharmacists to keep adequately informed about them. We are hopeful that the proposed regulations will . . . bring about a general improvement in drug promotion practices. At the same time, they should furnish a basis for more effective government control where necessary."

Triennial Lasker Awards Given

The Eighth World Congress of the Internatonal Society for the Welfare of Cripples in September was the occasion for presenting the Lasker Awards given every three years through the society for "distinguished service to the physically handicapped." The 1960 recipients are: Paul W. Brand, M.D., missionary surgeon of Vellore, India; Dr. Gudmund Harlem, Norwegian Royal Minister of Health and Social Affairs; and Mary E. Switzer, director of the Office of Vocational Rehabilitation.

Each award consists of $2,500, a citation, and a silver statuette of the Winged Victory of Samothrace. The society is a federation of voluntary organizations in 36 nations.

Do-It-Yourself: Operation Reality

In the fall of 1958, the director of the combined Health Department-VNA nursing program in Richmond, Va., and the director of the nursing program of the Johns Hopkins School of Hygiene and Public Health, with the encouragement of their respective administrative superiors, began to explore the idea of a joint effort in which the agency and the school would carry out a continuing program of field studies in public health nursing. The plan as it developed represented a departure from the usual university-field relationship in that the field was to provide the impetus and set the directions. The action pattern desired was that of a staff studying its own problems with help, rather than of academic investigators using a field for studies tenuously related to the situation in which they are conducted. It was hoped, then, that studies resulting from joint efforts would be selected to meet the needs of the community as well as those of the investigator.

Planners agreed that such an arrangement would likely be profitable: for the school, since the plan would provide a field in which students could subject theoretical public health concepts to the test of reality; for the agency, since the arrangement would provide a valuable resource for the systematic study of operational problems in need of solution.

The first phase of the operation included the development of an acceptable philosophy and ground rules for the projected program: (1) to simplify the job of learning to work together, the collaborative effort is at first being restricted to nursing; (2) for the present all problems will be brought into focus by the field staff rather than the university in order to encourage the nursing staff to discover fresh avenues for study of problems most likely to affect operational or service activities; (3) the total staff of the nursing division would decide on, and carry out its studies using the total Health Department staff and total School of Public Health faculty as resources; (4) the degree of commitment of agency and school to this partnership would be attested by the completion of at least one substantive joint study without "outside" subsidy. (It is the hope of the group that no future outside financing will ever result in "outside" studies.)

The first joint study grew out of the nursing staff's recognition that the evaluation of nursing services was a troublesome problem for which they would like to find some solution. In planning the study, it became apparent that to evaluate nursing services realistically one would first have to measure the progress of the family receiving nursing supervision. But before that was possible one would also have to be able to assess family capabilities to provide for its own nursing needs.

Thus the initial project is considered a pre-research venture, being addressed to solving the underlying problem: how to appraise family status in terms of public health nursing needs. With a reliable appraisal system one could demonstrate periodic change in family status and, in turn, have a useful device for evaluation of service. It should then be possible to categorize families in relation to the demand they can legitimately place on nursing. A workable system would enable one to estimate specific anticipated outcomes, and so would also serve as a desirable planning and staff education tool.

To those involved, it has become apparent that this type of joint investigation of practical programs would be equally helpful in problems of fields other than nursing. With modifications it could be applied, for example, to problems in environmental health services or in appraising the status of natural communities within a city.

Those reporting on this undertaking are Frederick A. Clark, M.D., M.P.H., chief, Bureau of Preventive Medical Services, Richmond Health Department; Ruth B. Freeman, R.N., Ed.D., consultant, on leave from Johns Hopkins, to Medical and National Sciences program, Rockefeller Foundation; Marie Lowe, R.N., director, Instructive Visiting Nurse Association, Richmond; and Ernest L. Stebbins, M.D., M.P.H., dean, School of Hygiene and Public Health, Johns Hopkins University. They suggest that this type of investigation "represents only one of the research areas with which schools must concern themselves, and only one of a multitude of administrative methods by which agencies can attempt to solve their problems. However, if this current mutual arrangement can proceed with a clear, consistent, and persistent adherence to the philosophy on which it is based it should offer an opportunity for agency staff members to approach their work in a more professionally oriented way, and should provide the University with valuable opportunities for an administrative research."

Patient-Dentist Rapport Preserved

A prepaid union dental care program has been termed a success at the end of a three-year experience, according to the president of the Oregon State Dental Association which operates the plan through the Oregon Dental Service Corporation. Beneficiaries are dependent children up to age 15 of members of the International Longshoremen's and Warehousemen's Union and Pacific Maritime Association (ILWU-PMA). Approximately 2,300 children and 355 dentists are involved. Orthodontics, bridgework, and purely cosmetic services are not included because of the experimental nature of the program.

William W. Howard, D.D.S., Portland, Ore., president of the corporation, points out in the August issue of the Journal of the American Dental Association that originally "many dentists were apprehensive about what form the program might take and what its effects might be on private practice." After three years of operation, a survey of 179 participating dentists showed that the vast majority felt the patient-dentist relationship had been improved or was unchanged; 134 felt that fees were about right and 148 said they would like to see other unions adopt similar plans.

Grants: Training, Research, et al.

The Office of Vocational Rehabilitation has approved a new Rehabilitation Counselor Training Program at the University of Pittsburgh. Candidates for M.Ed., Ed.D., and Ph.D., in this field may enter this program in September, January, or April of any year. Stipends of $1,800, $2,000, $2,800 and $3,400 are awarded by OVR. Information from Dr. L. Leon Reid, associate professor, coordinator, Rehabilitation Counselor Training Program, Department of Special Education and Rehabilitation, University of Pittsburgh, Pittsburgh 13, Pa.

The National Foundation offers postdoctoral fellowships to candidates for training in research, orthopedics, preventive medicine, arthritis and related diseases, and rehabilitation. The closing date for submitting applications to be reviewed in February is November 1. Financial support of the Fellow varies according to his previous education, his professional experience, marital status, and number of dependents, but the minimum is $4,500 a year with $540 allowed annually for each dependent. For a full academic program, complete tuition and fees are paid. United States citizenship is required, but those who have filed a petition for naturalization

will be considered. Fellowships are ordinarily awarded for a minimum of one year. Details from the National Foundation, 800 Second Avenue, New York 7.

This year the National Tuberculosis Association is accepting applications for grants for social research in tuberculosis and other respiratory diseases as well as for medical research. Requests are processed through NTA's medical section, the American Thoracic Society (formerly the American Trudeau Society). December 15, 1960, is the deadline for submission of applications for the grant year July 1, 1961, through June 30, 1962. Further information from the Division of Research and Statistics, American Thoracic Society, 1790 Broadway, New York 19.

N. B. for Social Workers Going West

The Bureau of Public Health Social Work, California State Department of Public Health, announces that its Annual Institute for Social Workers in Local Health Departments of California will be held in the Berkeley Headquarters of the State Health Department this year on October 28. Thus, it comes close upon the time and near the city of the 88th Annual Meeting of the APHA (October 31-November 4). The bureau is therefore opening the registration for the institute to a limited number of out-of-state participants.

The institute, entitled "Who's Our Client" will be concerned with the identification of social health problems in the community and the provision of services to meet needs. The program will be focused on the development in the County of San Mateo of a structured approach to social, economic, and health problems—philosophy, programing, methodology—and its application to public health social work programing. The institute faculty will include representatives of major agencies in the area involved in the services discussed.

Interested readers of this late news should register promptly. The bureau is at 2151 Berkeley Way, Berkeley 4, Calif.

Public Health Service Reorganization

In June, Surgeon-General Leroy E. Burney released the Final Report on the Mission and Organization of the Public Health Service, prepared by a study group appointed December 29, 1959, with James M. Hundley, M.D., as chairman and Margaret D. West as secretary. The schedule for applying the recommendations of the study group will to some extent depend on enabling legislation.

The major tasks ahead, as seen by the study group, are management of the physical environment and comprehensive health care. The main burden of these tasks would be assigned to a new Bureau of Environmental Services and a new Bureau of Community Health—fission products of the present Bureau of State Services. But the persistent interlocking of such tasks is seen in assignment of occupational health services to the environmental side, and assignment of accident prevention and communicable disease control to the bureau concerned with health care.

Upon implementation of recommendations the Bureau of Medical Services will be charged primarily with providing and staffing health facilities for federal beneficiaries and with quarantine duties, although its research activities are expected to expand. Of the four proposed bureaus, this one alone would have no grants programs; grants for hospital surveys and facilities would be administered in the Bureau of Community Health.

The most significant changes contemplated in the fourth bureau, the National Institutes of Health, are a center for

advanced study and an office of international research.

The study group recommends that the Office of the Surgeon General be enlarged with adequate staff to strengthen administration, communication, planning, and decision-making. In all four bureaus, staff functions are identified as including administration, program planning and analysis, and health information and education.

Separate status is provided for (1) the National Library of Medicine and (2) a National Center for Health Statistics which would include the National Office of Vital Statistics and the National Health Survey.

Decentralization of the grants program, so that each of three bureaus would distribute funds for research, training, fellowships, construction, and health services, is expected to strengthen communications between grantees and the related health programs.

The Miracle of Human Reproduction

The Cleveland Health Museum has assembled an array of three-dimensional models, plastic carvings, animated diagrams, dioramas, actual specimens, and push-button exhibits, for its "Wonder of New Life" exhibit, recently placed on view.

Described as a "first," the exhibit is not limited to a portrayal of the so-called "facts of life." In addition to the famous Dickinson Collection, it includes displays on: Heredity—Father determines sex; Mental Health—Preparing for the third child; The Story of Fertilization—A giant plastic egg showing the union of male and female germ cells; and From the Beginning of Labor to the First Cry—The main items of its collection of sculptured models. Many other subjects are covered, including: The Menstrual Cycle, Endocrine Glands, When to Expect Baby, Your First Five Months, Life Before Birth, and Why and Wherefore of Twinning.

This new exhibition is part of the $106,000 "New Look" development program which calls for complete modernization of the museum exhibits.

PERSONALS

Lt. Col. V. Harry Adrounie, USAF, MSC,* environmental medicine officer, Aerospace Medicine Division, Office of the Surgeon General of the Air Force, Washington, D. C., is president-elect, National Association of Sanitarians, Denver, Colo.

Josephine Ann Cipolla, R.N., formerly occupational health nurse, Statler Hilton Hotel, Buffalo, N. Y., is assistant executive secretary in charge of the Occupational Health Nurses Section, American Nurses' Association, New York City.

Albert Damon, M.D., assistant professor of medical anthropology since 1958, has been named associate professor of epidemiology, Harvard School of Public Health, Boston.

C. Wesley Eisele, M.D., assistant dean in charge of postgraduate medical education, University of Colorado School of Medicine, Denver, has been elected president, Commission on Professional and Hospital Activities, Inc., Ann Arbor, Mich.

Raymond M. Ewert, M.P.H.,† formerly consultant in health education, Wisconsin Anti-Tuberculosis Association, Milwaukee, is now director of public health education, Sonoma County Department of Public Health, Santa Rosa, Calif.

Roy F. Fritz, M.P.H.,* scientist director, Public Health Service, formerly on detail to the International Cooperation Administration as chief, Malaria Eradication Branch of the Office of Public Health, Washington, D. C., is on a five-year appointment to WHO's Expert Advisory Panel on Malaria.

Patricia Hanna, R.N.,† formerly public health nurse supervisor, Atlantic and Camden Counties, N. J., is now public health nurse consultant, Public Health Nursing Program, with special assignment to the Division of Chronic Illness Control, New Jersey State Department of Health, Trenton.

John T. Hughes, D.D.S., M.P.H.,† formerly staff public health dentist, is now assistant director, Division of Oral Hygiene, North Carolina State Board of Health, Raleigh.

Peter C. Karalekas,† chief water engineer, Springfield Water Works, Springfield, Mass.,

* Fellow.
† Member.

has been elected vice-president, USA Section, Interamerican Association of Sanitary Engineers (AIDIS).

JAMES G. KELLY, Ph.D.,† formerly Public Health Service postdoctoral research fellow, Community Mental Health Program, Harvard School of Public Health, Boston, is now scientist, Mental Health Study Center, NIMH, Langley Park, Md.

WILLIAM H. LARKIN,† assistant executive secretary, Water Pollution Control Board, New York State Department of Health, has retired after more than 30 years of service in the department. He is now supervising Iran's environmental sanitation program on a two-year assignment with the International Cooperation Administration.

JAMES E. MCCORMACK, M.D., formerly associate dean of the Post-Graduate School, College of Physicians and Surgeons, Columbia University, New York City, is now dean of the Seton Hall College of Medicine, South Orange, N. J.

IRENE BURNS MILLER, formerly western field consultant, is now program director, Committee on Careers, National League for Nursing, New York, N. Y.

GEORGE MOORE, M.D., M.P.H.,* formerly director, Health Mobilization Program, Region III, PHS, is now consultant, Regional General Health Services, Region III, PHS, Charlottesville, Va.

ANDREW C. OFFUTT, M.D.,* secretary and state health commissioner, Indiana State Board of Health, was honored in May with the Tri-State Hospital Assembly's annual Award of Merit for his outstanding contributions in the field of hospital administration.

IRVING OLITZKY, Ph.D.,* formerly bacteriologist, Cappel Laboratories, West Chester, Pa., is now chief, Bacteriology Division, Bio-Science Laboratories (12330 Santa Monica Boulevard), Los Angeles 25, Calif.

VIRGINIA PENCE, M.P.H.,* formerly consultant in community organization, Division of Local Health Services, is now director, Division of Health Education Services, Kansas State Board of Health, Topeka.

AGNES V. PETERSON,† formerly administrator, Pilot Study in Tuberculin Testing of School Children, Oahu Tuberculosis and Health Association, Honolulu, is now a generalized consultant, Public Health Nursing Section, Oregon State Board of Health, Portland.

THEODORE R. PFUNDT, M.D., formerly pediatric consultant, Oklahoma State Department of Health, and associate director, Oklahoma Poison Information Center, is now chairman, Department of Pediatrics, Creighton University School of Medicine, Omaha, Neb.

JOB L. PRAK,† formerly director of public health services, Ross Laboratories, Columbus, Ohio, is presently associated with Storck Pharmaceuticals, Inc., at its Columbus, Ohio, offices.

ROBERT L. JOHNSON,* formerly executive director, The Medical Foundation, Inc., Boston, Mass., is now director of community services, University of Kentucky Medical Center, Lexington.

HERBERT H. ROGERS,* formerly chief, Environmental Health Training Section, Communicable Disease Center, Atlanta, Ga., is now chief, Water Resources Development Section, Region IV, PHS, Atlanta.

SIDNEY SHINDELL, M.D., formerly medical director, American Joint Distribution Committee, Geneva, Switzerland, is now health officer for the Southwest District Office of the Allegheny County Health Department, Pittsburgh, Pa.

EMILY MYRTLE SMITH,* formerly assistant chief nurse, Federal Employee Health Branch, Bureau of Medical Services, PHS, is now nursing consultant, Nursing Home Services Section, Chronic Disease Program, Division of Special Health Services, PHS, Washington, D. C.

DONALD L. SNOW,* chief, Sanitary Engineering Branch, National Institutes of Health, has been elected a section director, USA Section, Interamerican Association of Sanitary Engineers (AIDIS).

MARIAN R. STANFORD, M.D.,† director, Division of Chronic Illness Control, New Jersey State Department of Health, has retired. She was with the department for more than ten years.

LIEUTENANT RICHARD H. SVIHUS, MC, USN,† formerly with Johns Hopkins University, is serving as epidemiologist, U. S. Navy Preventive Medicine Unit No. 7, at Naples, Italy (PMU No. 7, Box 41, Navy 510 FPO, New York, N. Y.).

JANE B. TAYLOR, R.N., M.P.H.,* formerly assistant nursing director, Bureau of Public Health Nursing, Indianapolis, Ind., is now nursing director, Public Health Nursing Association of Des Moines, Iowa.

H. R. WAGENBLAST, M.D.,† formerly director, Salina-Saline County Health Department, Kan., is now engaged in the private practice of medicine.

RICHARD L. WENZEL, M.D., M.P.H.,* formerly health commissioner, Washington County Health Department, Marietta, Ohio, is now associate professor of public health administration, University of Michigan School of Public Health, Ann Arbor.

* Fellow.
† Member.

WILMA YORK, R.N.,* formerly director of public health nursing, Marin County Health Department, Calif., is now assistant professor of public health nursing, Orvis School of Nursing, University of Nevada, Reno.

JOHN B. YOUMANS, M.D., formerly technical director of research U. S. Army Medical Research and Development Command, Washington, D. C., is now director, Division of Scientific Activities, American Medical Association, Chicago.

DEATHS

CHARLES H. BENNING, M.D., M.P.H.,* health commissioner, Wilmington (Del.) Health Department (Health Officers Section).

HERMAN N. BUNDESEN, M.D.* president, Chicago (Ill.) City Board of Health since 1931, on August 25 (Health Officers Section).

MARTHA A. FRIOUX, R.N.,† on July 23 (Public Health Nursing Section).

CHARLES ALLEN NEAFIE, M.D., M.S.P.H.,* deputy director, Oakland County (Mich.) Health Department in May (Health Officers Section).

MARGARET P. STIMMEL, M.S.,† assistant professor of bacteriology, Colorado State University, July 22 (Mental Health Section).

STANLEY E. TELSER, M.D.,* medical director, Chicago Health Center, Chicago, Ill. (Medical Care Section).

CONFERENCES AND DATES

American Public Health Association, Eighty-Ninth Annual Meeting, Detroit, Mich. November 13–17, 1961.

Eighty-Eighth Annual Meeting, San Francisco, Calif. October 31–November 4, and Related Organizations, including:

American Association of Public Health Physicians
American Association for Vital Records and Public Health Statistics
American College of Preventive Medicine
American Industrial Hygiene Association
American National Council for Health Education of the Public
American School Health Association
American Society of Professional Biologists
Association of Business Management in Public Health
Association of Reserve Officers of the USPHS
Association of Schools of Public Health
Association of State and Territorial Public Health Nursing Directors
Association of Teachers of Preventive Medicine
California School Health Association
Cleveland Health Museum National Advisory Council
Commissioned Officers Association of the USPHS
Committee on Medical Care Teaching, ATPM
Conference for Health Council Work
Conference of Health Economists
Conference of Municipal Public Health Engineers
Conference of Public Health Training
Conference of Public Health Veterinarians
Conference of State and Provincial Public Health Laboratory Directors
Conference of State Sanitary Engineers
Conference of State and Territorial Directors of Public Health Education
Division of International Health, PHS
Group Health Association of America
Industrial Medical Association
International Cooperation Administration, Office of Public Health
Mental Health, Public Health and Psychiatric Nurses
Military Government-Civil Affairs Public Health Society
National Association for Retarded Children
National Association of Sanitarians
National Citizens Committee for the World Health Organization
National Rehabilitation Association
National Society for the Prevention of Blindness
Public Health Cancer Association of America
Social Workers in Health and Welfare Programs
Society of Public Health Educators

Alumni Groups:

California Public Health Alumni Association, University of
Columbia University School of Public Health and Administrative Medicine Alumni
Delta Omega Society
Harvard Public Health Alumni Association
Johns Hopkins University Alumni
Michigan Alumni, University of
Minnesota, University of

* Fellow.
† Member.

North Carolina School of Public Health Alumni, University of
Pittsburgh Alumni, University of
Toronto School of Hygiene Alumni, University of
Tulane University Alumni
Yale University Alumni

State and Regional Public Health Meetings—October, November, and December:

Connecticut Public Health Association. Grantmoor Inn, Meriden. November 17.

Florida Public Health Association. Carillon Hotel, Miami Beach. October 13-15.

Hawaii Public Health Association (Pan Pacific Health Conference). Hawaiian Village Hotel. Honolulu. November 7-8.

Maryland Public Health Association. Emerson Hotel, Baltimore. October 7.

Mississippi Public Health Association. Robert E. Lee Hotel, Jackson. December 7-9.

New Jersey Public Health Association. Kingsley Arms Hotel, Asbury Park, October 25.

Tennessee Public Health Association. Maxwell House Hotel, Nashville. October 5-7.

Washington State Public Health Association. Spokane. October 2-4.

Meetings of Other Organizations:

American Academy of Pediatrics. Palmer House, Chicago, Ill. October 17-20.

American Association of Medical Record Librarians. Olympia Hotel, Seattle, Wash. October 10-13.

American College of Surgeons. Annual Clinical Congress. San Francisco, Calif. October 10-14.

American Dental Association. Los Angeles, Calif. October 17-20.

American Dietetic Association. Cleveland, Ohio. October 18-21.

American Heart Association. Jefferson Hotel, St. Louis, Mo. October 21-25.

American Institute of Oral Biology. Palm Springs, Calif. October 8-12.

American Medical Association. Statler Hotel, Washington, D. C. November 29-December 2 (Clinical Meeting).

American Medical Writers' Association. Morrison Hotel, Chicago, Ill. November 18-19.

American Occupational Therapy Association. Statler Hilton Hotel, Los Angeles, Calif. November 11-18.

American Psychiatric Association. Salt Lake City, Utah. October 17-20.

Association of American Medical Colleges. Diplomat Hotel, Hollywood Beach, Fla. October 30-November 1.

Association of State and Territorial Health Officers. San Francisco, Calif. October 27-29 (tentative).

Congress on Industrial Health. Hotel Charlotte, Charlotte, N. C. October 10-12.

Industrial Hygiene and Air Pollution Conference. University of Texas, Austin. December 3.

International Association of Milk and Food Sanitarians. Hotel Morrison, Chicago, Ill. October 26-29.

International Convention of Nutrition and Vital Substances (Sixth). Baden-Baden, Germany. October 5-9.

Muscular Dystrophy Associations of America. New York, N. Y. October 13.

National Association of Housing and Rehabilitation Officials. Cincinnati, Ohio. October 18-21.

National Citizens Committee for the World Health Organization. Palace Hotel, San Francisco, Calif. November 2.

National Association for Mental Health. Denver, Colo. November 17-19.

National Committee on the Aging. Belmont-Plaza Hotel, New York, N. Y. October 17-19.

National Conference on Water Pollution. Washington, D. C. December 12-14.

National Federation of Licensed Practical Nurses. Cole Hotel, Albuquerque, N. M. October 10-14.

National Safety Council. Conrad Hilton Hotel, Chicago, Ill. October 17-21.

National Rehabilitation Association. Oklahoma City, Okla. October 10-12.

National Social Welfare Assembly. New York, N. Y. December 5-6.

National Social Welfare Assembly—National Committee on the Aging. New York, N. Y. December 6-7.

Planned Parenthood Federation of America. New York, N. Y. November 15-16.

United Cerebral Palsy Associations. Saxony Hotel, Miami Beach, Fla. November 19-21.

Water Pollution Control Federation. Sheraton Hotel, Philadelphia, Pa. October 2-6.

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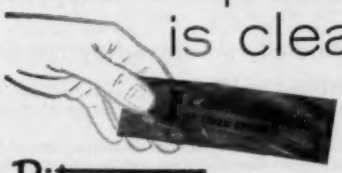

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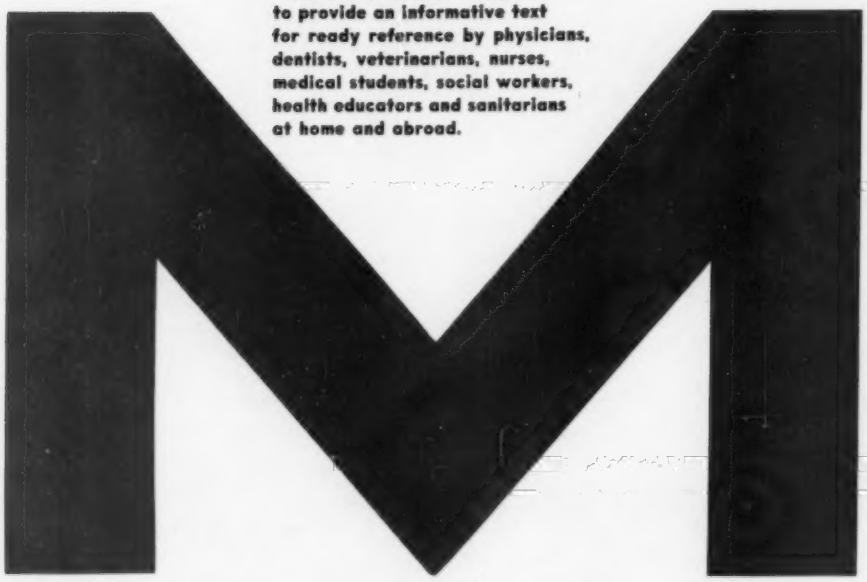

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hypertension and arteriosclerosis

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AMERICAN HEART ASSOCIATION — NATIONAL HEART INSTITUTE

Epidemiology of Cardiovascular Diseases Methodology

hypertension and arteriosclerosis

Guest Editors: Herbert Pollack, M.D., and Dean E. Krueger

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EPIDEMIOLOGY OF CARDIOVASCULAR DISEASES

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PREFACE

THE Conference on Methodology in Epidemiological Studies of Cardiovascular Diseases was devoted to problems of measurement in selected aspects of these studies. Held at the Princeton Inn, Princeton, N. J., April 24-26, 1959, it was cosponsored by the American Heart Association and the National Heart Institute, United States Public Health Service.

Subjects considered include criteria for the diagnosis and clinical evaluation of arteriosclerotic heart disease and hypertension; dietary, physical activity, and biochemical measurements; assessment of cultural, societal, familial, psychological, and genetic influences; and general problems of design of studies and analysis of data.

This is the report on the third conference cosponsored by the two organizations and directed to research on cardiovascular diseases. The First National Conference on Cardiovascular Diseases, held January 18-20, 1950, in Washington was concerned with the entire range of technical knowledge and research, community services and facilities, professional education, and with all cardiovascular diseases.[1] The Conference on Epidemiology of Atherosclerosis and Hypertension at Arden House, Harriman, N. Y., January 29-February 2, 1956, reviewed current etiological concepts in those diseases and tools available for studies of population groups to test those concepts and provide new leads for further investigation.[2] By 1957, several groups had either begun or were planning long-term studies of cardiovascular diseases in population groups. (Representatives of these groups met at the Hotel Beaconsfield, Brookline, Mass., June 17-18, 1957, at the invitation of the Framingham Heart Disease Epidemiology Study, National Heart Institute, to exchange information and consider problems of diagnostic criteria and clinical and laboratory procedures.)[3]

With this background of interest and experience in epidemiological research in cardiovascular diseases, the cosponsoring organizations felt that the time had come to devote specific attention to problems of measurement faced by individual investigations and to the potential value of being able to combine or at least compare results of several investigators using standard measurements. The conference worked toward this goal, not with the idea of selecting the "best" method for measuring any factor which might be important in epidemiological studies of cardiovascular diseases, but by considering all available methods, giving their judgment about minimum base line measurements which should be included in every epidemiological study of cardiovascular diseases, and about optimum measurements which should be made in some studies when the circumstances enable use of these more precise methods.

Prior to the conference, nine working groups met to consider problems in the subject areas noted above, and prepared preliminary reports for presentation to the conference. Members of the Committee on Design and Analysis of Studies participated in meetings of each of the other groups. This was a highly productive preconference activity. I wish to express my appreciation to each of the 60 people who contributed to the preconference work as members of committees, and especially to the chairmen of these groups, to Dr. Herbert Pollack, chairman of the conference, and to Mr. Dean E. Krueger, executive secretary. All of these, as well as other persons who attended the conference, are listed following this preface.

The report of each of the nine groups which met prior to the conference was presented and discussed at length in

general sessions. Each group, augmented by other conference participants who were particularly interested in the subject area, also met separately to consider the preliminary report and the discussion in general sessions. Revised reports were presented at the closing general session.

This publication also reflects work by committee chairmen, and in some instances committee members after the conference, as well as the continuing attention of the editors and technical assistance from the Heart Information Center, National Heart Institute. Mrs. Mary Howes, National Heart Institute, provided secretarial service prior to and during the conference, and typed the manuscript of this report.

JOHN W. FERREE, M.D.,* Associate Medical Director, American Heart Association

REFERENCES

1. First National Conference on Cardiovascular Diseases, American Heart Association, New York, N. Y.
2. Conference on Epidemiology of Atherosclerosis and Hypertension, Harriman, N. Y.: American Heart Association, 1956 (duplicated).
3. Dawber, T. R. (Ed.). Report of the Conference on Longitudinal Cardiovascular Studies, Hotel Beaconsfield, Brookline, Mass. (June 17–18), 1957 (duplicated).

* As of September, 1959, executive director, National Society for the Prevention of Blindness.

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[1] The following persons participated in preconference work but did not attend the conference: Sayde F. Adelson, Institute of Home Economics, Agricultural Research Service, USDA, Washington; Norman Allaway, New York State Dept. of Health, Albany; Virginia Beal, Child Research Council, University of Colorado School of Medicine, Denver; Adelia Beeuwkes, University of Michigan, School of Public Health, Ann Arbor; Wilma Brewer, Ph.D., Iowa State University Department of Food and Nutrition, Ames; Marjorie Cantoni, Heart Disease Control Program, USPHS, Washington; Icie Hoobler, Ph.D., Merrill-Palmer School, Detroit; and Bernice Watt, Ph.D., Institute of Home Economics, Agricultural Research Service, USDA, Washington, D. C.

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CHAIRMAN'S ADDRESS

Herbert Pollack, M.D., F.A.P.H.A.

I WANT to welcome you to this Conference on Methodology in Epidemiological Studies of Cardiovascular Diseases. One might ask, "How did this conference get started and who sparked it into being?" The point of origin would appear to be a letter from Dr. A. C. Corcoran to Dr. James Watt, written by Dr. Corcoran shortly after returning from a visit to the School of Public Health at the University of Michigan in July, 1958. Dr. Corcoran wrote that while there he had discussed "the urgent need for standardization of procedures in cardiovascular surveys. . . ." This letter set in motion the machinery which resulted in this meeting.

Although the purposes of this conference have been explained to you, I should like to restate them briefly:

One, to set up minimum acceptable base line measures in specific areas, thus providing comparability in epidemiological surveys. Two, to suggest optimum procedures. Three, to define gaps in methodology, and to suggest studies to fill these gaps. During the deliberations of this conference, we should continuously bear in mind these major objectives which will govern the final report.

The chairman wishes to express at this point his deep appreciation for the hard work of the many persons responsible for the administrative and operational chores involved in a meeting of this type. This conference is sponsored by the American Heart Association and the National Institutes of Health through the National Heart Institute. Mr. Dean Krueger, executive secretary, is basically responsible for most of what has taken place. Dr. William Zukel, Dr. John Ferree, and many others have devoted a tremendous amount of time to the organization of this meeting—the happy culmination of which we see here.

In Biblical times, the concept of the relationship of the environment to the individual, and the individual to the environment, was stated somewhat differently than it is today. Formerly, the phrase, "The world, the flesh, and the devil," was used. Today, we discuss the environment, the host, and the cause of the diseases. The health of the community, as well as the diseases of the community, are expressions of the relationship between the three factors enumerated. Even in Biblical times there was a concept of the epidemiological or the ecological approach to disease.

To fully understand the variations of the incidence of mass disease one must draw upon world experience rather than the small segment represented by a given community. Diseases and disease states show many variations, depending on environmental conditions under which they are observed. The epidemiological approach—based upon the ecology of the individual—makes use of these types of data; it uses the methods of all the scientific disciplines represented here today: clinical medicine, statistics, social science, pathology, biochemistry, experimental physiology, and many others.

Those attending this conference recognize that in the history of medicine no disease has ever been conquered by an attempt to treat every affected individual. It is only by studying the etiology through the epidemiological approach that man has been able to stamp

out mass disease. It is hoped that this approach can be applied to the problem of cardiovascular disease.

One purpose of this conference is to point out to those interested in this area of investigation the questions that remain to be answered. Certain criteria will be set up which can be made applicable to large areas as standards for the collection of data. If we are to compare data from one area of the country with that from another, or data from one part of the world with that from another, obviously these must be collected with such comparisons in mind. Standards used in all studies when reporting deviations from the normal should be mutually acceptable and understandable so that end results can be meaningful in all countries; to use different standards in various parts of the world is like conversing in different languages without a translator.

As chairman, I am enthusiastic at the opportunity of working side by side with specialists from the many disciplines represented here. It is a challenge—and also a real problem in coordination. But, then, the essence of good epidemiological research is the coordination of many specialists toward a common goal. One must not minimize the value of personal views; the concept that permits any person to report, but only certain ones to advise, is unacceptable for this meeting. If it were acceptable it would result in too great a reliance on so-called "study groups" of all types.

While this is a new panel, it can also be viewed as a historical extension of the Brookline Conference. Let us not, therefore, fall into the error of many new panels that act as if nothing had ever been done before—perhaps because the continued existence of the problem before the panel is taken by some as an indication of the inadequacy of previous conferences.

The effective results of a conference of this type depend not only on the contributions of each participant but on something even more important; namely, the working relationship of each individual to his fellow members and to the group. The value of the final report could be negated if the individual problems of specialists became isolated from the group and each problem were disposed of in its own way—by experts, to be sure—but by experts whose only interest is the special difficulties involved in their own particular area.

Conferences of this type can be extraordinarily useful; not only can they provide us with fresh points of view but they can also provide us with an excellent way of locating talent that would otherwise be unavailable. The number of outstanding individuals with experience in any one field is limited. As a result the same group is called upon time and time again to review these and related tasks. The type of panel present today is somewhat different from the usual one. Usually in panel deliberations, the question stands or falls on the skill with which it is presented. Hence, there is a premium for quickness of comprehension by the successful committeeman. Here, we hope that the more important quality of reflectiveness, rather than fluency in speaking, will predominate.

There will be a further difference from previous panels. Usually panels are expected to adjust differences that exist between participants; therefore, it is not surprising to find them ending up with a resolution which is a common denominator rather than a well rounded, creative point of view. I hope we will not return to the common denominator type of resolution. If we do not, this conference will contribute an important concept to the technic of solving problems.

The development of short-term expedience is not the purpose of this conference, nor are we attempting to find Utopia, where all questions will be

answered and all problems solved. We are not looking for the registration of dissenting points of view. We do seek from you a significant contribution to the field which will give a sense of direction to the development of epidemiological methods for study of the cardiovascular diseases.

In bringing together the various disciplines for this conference, we hope that each of you will have the opportunity to present your most important considerations and to understand the point of view of other disciplines. It will be necessary to place a premium on those phases of other disciplines which cannot be most easily duplicated by your own. Personally, I would recommend that you listen particularly to phases of ancillary disciplines which are unrelated to your own—these are the ones that require integration into your own field of expertness. The speculation which we seek can exist only when the facts are not known; with the development of these facts, the areas of speculation are gradually narrowed and then disappear.

FRAME OF REFERENCE OF CONFERENCE COMMITTEE REPORTS

THE committees took advantage of reports on prior conferences on cardiovascular disease research in the United States, cited in the Preface, as well as those by Expert Committees of the World Health Organization, to which some of the committee reports refer. The scientific knowledge of members of the committees, however, provide the major basis for this report.

The committee reports reflect the information most acceptable to participants in the conference and, in general, their consensus regarding the adequacy and limitations of presently available methods, and their ideas about research needed to improve or develop new methods.

Credit and responsibility for the content of these committee reports rests primarily with the chairmen, and secondarily with committee members and other participants in the conference.

A special note is in order about the report of the Committee on Cultural, Societal, Familial, Psychological and Genetic Influences on Cardiovascular Diseases. Diverse scientific disciplines —in many instances represented by one person—were included in this group. The report is presented as the chairman's interpretation of information provided by members of his committee, coupled with his own broad knowledge of the subject. It did not seem feasible, in the limited time available, to attempt to arrive at a synthesis of ideas on methodology in an area of study in which there are so many unknowns.

COMMITTEE ON DESIGN AND ANALYSIS OF STUDIES

Felix E. Moore, F.A.P.H.A., Chairman

IT IS clear that the problems of design and analysis in epidemiological studies of long-term disease are so varied and complex that nothing short of a lengthy treatise could provide adequate coverage. Such a treatise has not yet been written, and its formulation is clearly outside the capabilities of an ad hoc committee meeting for a limited period. The committee has concerned itself, therefore, with a small number of rather general problems which appear to be recurring ones in this type of investigation. These are dealt with under two main headings: I. General Problems of Definition and Design, and II. Measurement Problems. The committee has also considered it necessary to confine its attention to those studies which are based on the clinical or pathological examination of individuals, thus omitting from consideration the types of studies based primarily on information secured by lay interviewers from household informants (morbidity surveys) and the types of studies based primarily on information from death certificates (mortality studies).

I. General Problems of Definition and Design

A. *Some General Characteristics of Epidemiological Studies*

Many types of studies which have contributed to advances in our knowledge of cardiovascular diseases have been termed "epidemiological." There appear to be common elements of design which characterize these studies and common problems in the interpretation of results which differentiate them from other approaches to the study of disease. The committee believes that it will be more profitable to outline these common elements and problems than to attempt to formulate a narrow definition.

Epidemiological studies have been referred to variously as "descriptive studies," "population surveys," "studies of association rather than causation," and have been contrasted with "clinical" or "laboratory" studies or "controlled experiments." Each of these terms has connotations which undoubtedly will vary from one investigator to another. By way of clarification of the concept, the committee suggests that the following elements are characteristic of epidemiological studies:

1. In an epidemiological study, the subjects studied include not only persons known to have the disease under consideration, but also persons who are free (or apparently free)* of the disease as well. This makes possible the search for factors which differentiate the two groups, or alternatively, the search for factors differentiating the subgroup among those free of disease who subsequently develop recognizable disease from the subgroup of those who do not. A frequent implication of the term

* In order to free the text of this report from the recurring circumlocution "apparently free of disease," the terms "free of disease" or "not diseased" will be used as labels for those persons in whom signs of cardiovascular disease (arteriosclerotic or hypertensive, as appropriate) cannot be observed by standard clinical or laboratory methods of assessment. It is recognized that this begs an important question which is discussed in section IIA of this report.

"clinical study" is that it is concerned only with the group which seeks medical attention for disease, yet in many "clinical studies" a "disease group" is compared with a "control group." The difference, if any, lies in the method by which the study groups are selected and the breadth of generalization which that selection permits, since epidemiological studies frequently require exhaustive "clinical" methods of evaluation. (See sections IA2 and IID for further elaboration of this point.)

2. The ideal epidemiological study would be based on probability samples from a very large population in order to permit generalization from the study group to the larger population with specifiable limits of precision. It is rare, however, that the ideal approach is possible; the circumstances under which epidemiological studies can be conducted often do not permit the drawing of random samples from the very large populations to which it would be desirable to generalize. It is important to recognize, therefore, that "generalizability" is a relative matter; rarely in practice will generalizations apply to broader populations without some restrictions. Knowledge of the parent population and the way in which the sample subjects were drawn are essential in evaluating limitations on generalizability in any epidemiological study. This information should be provided in the published reports of studies. The extent to which generalizability is required is dependent on the state of knowledge at the time; at an early stage of knowledge, a small study on a limited population may provide clues which can be explored in samples from broader populations to permit extension of the generalizations.

3. The first aim of epidemiological study is to identify characteristics of individuals and of their environment (broadly defined, environment includes all agents impinging on the individual) which are associated with the existence or occurrence of disease. These associations can be tested for statistical significance by standard technics, and it is now generally understood that the acceptance of the finding of "significant association" does not imply the establishment of a cause and effect relationship. Nevertheless, the search for associations is a search for factors which may be etiologic in the disease; the degree of confidence in which the associations are held, taking into account information from other sources such as hypotheses about mechanisms involved, should point the way toward conclusive studies of etiology.

4. In studies of human populations, it is rarely appropriate to study a single factor; usually, multiple factors and associations are studied. A number of probable factors in the etiology of cardiovascular diseases have been identified in previous studies. In the search for "new" factors, those already implicated should, wherever possible, be observed and taken into account in the analysis of the new study. Alternatively, certain variables may be "controlled" by limiting the study to groups of persons which are relatively homogeneous with respect to these variables, e.g., persons with specific age, sex, race, occupational, or other characteristics.

5. The observational epidemiological study lacks two important elements of the clinical or laboratory experiment. First, no attempt is made to alter the characteristics of the group under study; rather, there is dependence on the so-called "experiment of opportunity" in which concomitants of variations in the existing environment (external or internal) of the individual are analyzed in the same fashion as the sequelae of experimentally introduced changes in the controlled laboratory situation. Second, because no attempt is made to alter specific variables, the essential element of randomization of assignment of indi-

viduals to "treatment" and "control" groups is missing from this type of epidemiological study.* For example, in a study of the association of smoking with risk of coronary artery disease, by analogy with the "clinical trial" smokers may be regarded as the "treated" group and nonsmokers as the "control" group. Failure to "randomize" places restrictions on certain statistical generalizations and requires that they be considered as approximations to the experimental situation where true randomization is applied. On the other hand, the attempt to control "all relevant factors" in the experimental situation may well result in the loss of information on important interrelations, because the range of environmental factors is artificially limited. This may constitute a severe limitation to generalization.†

B. *The Time Reference of Studies: Retrospective and Prospective*

The pathologic changes involved in arteriosclerotic heart disease and hypertension develop over a period of years and appear to be influenced by host or environmental factors which exert their force over much of the lifetime of an individual prior to the time the diseases become clinically recognizable. Data pertaining to a substantial portion of the life span of the individual prior to identification of his disease are much more likely, therefore, to yield information of value than contemporary data alone. It is for this reason that time-span studies, either retrospective or prospective, are often regarded as superior to cross-sectional studies. In fact, each of the three methods has both advantages and disadvantages which must be balanced in the individual instance.

The prospective and retrospective approaches will be considered first, with the discussion of the cross-sectional study reserved for a later section (IC).

In the typical prospective study (which is frequently referred to as a longitudinal study or study of cohorts),‡ a population is selected for study without prior knowledge of the disease status of the individuals making up the population. Each individual is examined at the outset of the study and classified as diseased or free of disease. At the same time, data on other individual characteristics which might possibly be related to risk of disease are secured and recorded. Those free of disease are regarded as the population at risk, and are observed over some time period. At the end of the period, the population at risk can be classified into two groups: those who have developed manifest disease, and those who remain free of disease. It is also possible to classify the population at risk into groupings on other factors (e.g., lipid levels, body fatness, dietary patterns) which characterized each individual at the time of entry into the study. If differences in incidence of disease are found in the various groupings on some classification,

* It is recognized that there is an area of experimental epidemiology which has many of the aspects of the clinical trial, including randomization. This special type of study will not be discussed in this report.

† For more extended discussions of the points raised in this section and references to the literature, see references 1 and 2.

‡ There is not full agreement on appropriate terminology for describing various types of studies. In this report "prospective" and "longitudinal" are used synonymously for studies in which groups are followed from the time of definition forward in time. The term "cohorts study" has been proposed to describe the prospective study in which specific individuals are followed, in contrast to an alternative type of longitudinal study in which successive samples of an originally defined group are studied, rather than identical individuals. (This latter type of design has been discussed in reference 3 and is not further discussed in this report.) Since the term "cohort" in life table analysis implies a group of persons born in the same year, whose subsequent mortality experience is described, the term "cohorts study" would appear to be applicable to the type of longitudinal study where individuals of varying ages at entry to the study are followed in time.

the association suggests the presence of an etiological factor.*

In the typical retrospective study, one group of individuals is brought into the study because they have exhibited manifest signs of disease. A second group of individuals are selected for study who are free of disease. Often the latter group are matched with the former with respect to age, sex, or other factors. Data are then secured on other individual characteristics of the persons in the two groups in respect to life experience prior to development of disease, or, in the case of those free of disease, prior to entry to the study. As in the case of the prospective study, the characteristics of the two groups are examined for differences which will suggest etiological factors.†

There are many possible variations within these two types of studies, but the important difference between the two is that, in the prospective study, data on the diseased are recorded before the criterion event (or diagnosis) and in the retrospective study after the criterion event (though with respect to a time period before the event). In practice, nearly every prospective study makes use of some "retrospective" data, e.g., a lifetime history of smoking obtained at entry to the study, but the important difference is that it is secured before the occurence of the criterion event.

The retrospective approach contains certain problems of sampling design which may be very difficult, though not necessarily impossible, to overcome. At any given point in time it may be extremely difficult to secure a representative "coronary" population. The survivors, who are the only ones available for study, may be quite different, for example, from those who died in their first attack. If usual medical sources are used for the selection of the coronary population, some important groups of the population may be omitted. It is also difficult to specify the method of sampling for the selection of the appropriate comparison group.‡

Another problem in the retrospective study is that the occurrence of the criterion event may cause the affected individual (or his physician or a family informant) to revise the information that would have been presented in advance of the criterion event. It is for this reason that the burden of proof lies on the investigator in the retrospective study to demonstrate (perhaps by ancillary studies) that the occurrence of the criterion event does not affect reporting of prior events.

The kinds of data available for retrospective studies are frequently not determined by the investigator, nor recorded with his purposes in mind, nor as easily subject to validation procedures as are data recorded in a prospective study. Thus, the study dependent on past hospital records, may encounter frequent gaps and shifts in recording methods.

The prospective study encounters other and different sampling problems. One of the chief of these is the problem of nonresponse either in terms of refusal to participate in the initial examination, or refusal to participate in the follow-up examinations. The expense of the prospective study almost invariably limits the representativeness of the group which can be studied.

There are certain risks of bias in the prospective study in that the process of observation may itself influence the rate of development of disease in the population. There is also the possibility that early findings in the study will cause biases in subsequent observations.

* Descriptions of three prospective studies in the cardiovascular field will be found in reference 4.

† See reference 5 for description of a retrospective study of this general type.

‡ For extended discussion of sampling problems, see references 6 and 7.

Studies designed to assess these risks are needed.

The cost of maintaining a prospective study in operation for a period of time long enough to provide useful data and the problem of maintaining continuity of personnel are undoubtedly severe handicaps to its successful prosecution.

Both the prospective and the retrospective study are observational studies and neither can demonstrate causation in the same sense as an experimental study. The prospective study is theoretically superior to the retrospective study in sample design and in protection against the risk of biases in a posteriori observation and recording of data, and for these reasons it has been preferred by statisticians. On the other hand, skilled investigators have developed methods for protecting against many of the dangers of the retrospective study.* If these risks can be minimized by appropriate safeguards, the retrospective study will be attractive because of sizable savings in both the length of time required to produce significant findings and in cost.

Prospective studies can in some instances achieve some of the economy usually attributed to retrospective studies by delaying processing of data until its pertinence has been established. For example, in a prospective study of total serum cholesterol and coronary heart disease, sera for the entire study population could be stored, and cholesterol levels tested only for subjects in whom the disease occurs plus a relatively small sample of the vast majority of subjects in whom it does not occur.

In balance, at an early stage of knowledge the retrospective study is a relatively quick and inexpensive, but insecure, method for gaining insight into the etiology of disease. If the findings of such a study are challenged on the grounds outlined above, the challenge can only be answered by conducting a prospective study. But, as in the case of the smoking and lung cancer controversy, it is clear that even the prospective study is not immune to challenge when offered as proof for causal relations.

* Reference 5 provides examples of several methods for testing validity of retrospective data.

C. *Cross-Sectional Studies*

In the cross-sectional study, in contrast to the time-span studies, the analysis is based on comparison of observations on groups of individuals at a given point in time. It is useful to consider two types of cross-sectional studies.

In the first type, a group of persons with known disease are available for study and a group of persons free of the disease are selected for comparison. Each individual is thus characterized as to presence or absence of disease, and in addition by contemporary observations on other factors believed to be relevant to the disease process. The interpretation of the results must necessarily be based on the assumption that the differences observed between the two groups are similar to those which would have been found if it had been possible to observe the groups before the criterion event.

This type of study differs from the retrospective study previously described only in the fact that data are secured by contemporary observation and not by recall. While the cross-section study is thus protected against the possible effects of the criterion event on recall, this protection is secured at the expense of omitting data on the period prior to the criterion event. The cross-sectional study is subject to the possibility of bias if the disease group has, because of the occurrence of the disease, shifted its position with respect to predisease characteristics; shifts in characteristics may be physiological sequelae of the attack itself, or a result of subsequent treatment. Thus certain lipid

levels, or blood pressure, or weight, for example, might differ from those which existed before overt disease occurred. The cross-sectional study is subject to the same problems of sampling as the retrospective study in that those in the disease group represent only the survivors of some larger group which had experienced disease. The relatively large group of coronary cases which die suddenly in the first attack, for example, are rarely included in hospital series. If it should be shown that the sudden death group differed significantly from other coronary cases, then a study based on survivors only would yield a biased finding. Also, as with the retrospective study, it is difficult to specify what non-coronary group is appropriate for comparison because of uncertainty concerning the original disease-free population from which the coronary group arose.

In a second type of cross-sectional study, groups are characterized as to disease prevalence (or incidence) rates, and simultaneously characterized in terms of group averages with respect to other factors, e.g., proportion of caloric intake in the form of fats of various types. If differences in prevalence rates are found to be associated with group differences in other factors, it may be inferred that the factors have etiological significance. Groups may be chosen on many different grounds. For example, when it is found that groups selected for study on the basis of age and sex show different prevalence rates of disease, the inference is made that these factors are significant in assessing risk of disease. It is clear, from this trivial example, that analysis at this level will not throw much light on differentials in risk within age-sex groups unless individuals can be further subclassified both with respect to disease status and other characteristics. More frequently, this approach is used in comparing disease prevalence in groups differing in occupation or in geographic location (with accompanying racial, cultural, or other differences). It is clearly profitable to seek groups differing widely in disease prevalence and to explore other factors characterizing these groups with the hope that factors which differentiate the groups may provide leads for further investigation. Frequently a direct interpretation will be difficult because of the confounding of many factors.*

D. *Problems of Sampling: Selection of Comparison Groups*

In previous sections a number of problems of sampling have been touched upon. It has been pointed out that no population is "general" or "whole" in the sense of not having its own peculiar characteristics reflecting factors which may be of importance to the study of disease, such as its prior mortality experience, ethnic origins, age and sex composition, and a wide variety of environmental circumstances. Thus, the most defensible sampling methods insure only that the sample statistics will provide estimates of the parameters of the population sampled within specifiable probability limits. It seems probable that studies of cardiovascular disease of the depth required by the present state of knowledge will continue to be limited as to scope in both time and area coverage because of cost and limited availability of trained personnel. Under these circumstances the repetition of studies under comparable conditions, with well designed samples, and in different places, will provide reinforcement of similar findings even though there may be no statistical method for making a probability statement about the combined results.

In a number of international cross-

* This approach, sometimes termed geographical pathology, or human ecology, has been discussed in some detail in a publication which became available subsequent to the conference, see reference 8.

sectional studies now being carried out, the groups selected for study have been chosen by a method which has been referred to as "chunk" sampling.* The chunk may be a circumscribed occupational group (such as firemen in a given locality), or the residents of a small village. Within the chunk an attempt is made to secure 100 per cent coverage in order to avoid the bias of individual selection. Comparisons are then made between similar groups in different countries in order to draw inferences about possible causal factors when differences in disease prevalence are found. This approach has many advantages, and permits the carrying out of studies in areas where more extensive sampling would not be feasible. It must be recognized, however, that there are selective factors in affiliation of individuals with occupational groups and that these may vary from area to area. The utility of the chunk sampling approach will be increased as more comparative information is made available, not only concerning variations between chunks in different countries but also between individual chunks within a country and the remainder of the population of that country. Results from studies of this type must be interpreted in terms of present limitations on knowledge of the representativeness of the groups.

In the discussion of the typical retrospective and cross-sectional studies, it was pointed out that there are serious problems of sampling in the selection of the appropriate free-of-disease group for comparison with the disease group. These problems are of sufficient importance to warrant further elaboration here. In the traditional design of the experimental study, patients are assigned to treatment and control groups at random before the experiment, and it is this random assignment which makes presently available statistical theory appropriate for analysis. In the longitudinal study, the "treatments" are not assigned at random, since other individual nonrandom elements come into play in the placement of individuals into "treatment" groups on a factor such as, for example, body fatness. However, in the longitudinal study, the population out of which the diseased group originated is specified at the onset of the study, and can be classified on a single characteristic, such as degree of body fatness, from the beginning of the observation. Under these circumstances, it is appropriate to test the association between body fatness and risk of disease by testing whether the new cases of disease are distributed among the various body fatness groupings in a manner compatible with the assumption that there is only random variation from a uniform average risk in all groups—which supports the decision of "no association." Alternatively, if the distribution of new cases among the various body groupings is such that it would have been very unlikely to occur if there were only random variation from a uniform average risk, then the decision of "significant association" is supported. (It has already been remarked that association does not necessarily support the inference of causal connection.)

In the type of study where a comparison group of free-of-disease persons are selected for contrast with the disease group, there is neither the element of randomization in assignment of "treatment" found in the ideal experiment, nor is there the certain knowledge that the persons free of disease at conclusion of follow-up are the remainder of the original population from which the new disease cases came—the situation which makes permissible the type of statistical test described above in the typical longitudinal study.

There are, in fact, no logically de-

* For a discussion of this approach, and general problems in surveys, see reference 9.

fensible rules which can be specified for the selection of a comparison group in the type of retrospective or cross-sectional study where independent selection of diseased and free-of-disease groups is necessary. What can be specified is that the two groups should be as much alike as possible with respect to factors which are known in advance to differentiate the two groups.* The difficulty is to insure that the selection process does not permit the introduction of other factors which would differentiate the two groups and yet be unrelated to the disease process itself. Thus, when studies of this type are undertaken, a large part of the protection against misleading interpretations must rest on that part of the skill of the experienced investigator—medical or statistical—which is art rather than science.

E. *The Problem of Nonresponse*

General population studies in which clinical methods have been used for diagnosis of disease have rarely secured participation in American populations from more than three-fourths of the designated sample. Presently available technics, including use of mobile examining units conveniently located, apparently are not adequate to raise the response rate above this level.† Incomplete response introduces the strong possibility of bias in results, but the nature of this bias has not been adequately studied, because suitable means for doing so have not been found. There is urgent need for further methodological study in this area. It is also important that data on response rates be published in detail with the report of each study.

The completeness of examinations, in terms of procedures to which the subject is asked to submit and the time required to carry them out, appears to discourage participation. The desirability of completeness of information must therefore be balanced in any study against the desirability of a high rate of response.

In longitudinal studies, where the major comparisons are among groups of persons who actually participate, initial nonresponse is less serious than in cross-sectional studies, provided that virtually complete follow-up of the initially respondent group can be secured. A high drop-out rate subsequent to initial response could, however, be related to health status and thus introduce serious bias. Fortunately, it has been demonstrated in several longitudinal studies that, while it was impossible to secure complete response from the original sample, it has been much less difficult to secure reexamination on the original respondents.

Four types of information are useful in evaluating the effects of nonresponse in both longitudinal and cross-sectional studies:

1. Information about the individual's health status as reported by him in home interview by a lay interviewer—obtained prior to the invitation to participate in medical examination procedures.
2. Mortality data, and data from hospitals and physicians, on nonparticipants for comparison with similar data for participants.
3. Within the participating group, an analysis of health status among respondents classified according to the amount and type of effort required to secure participation.
4. Special sample studies of nonrespondents, possibly securing some minimal clinical observations in the home.

II. Measurement Problems

A. *Definition of the Disease Being Studied*

Our concept of disease changes when methods available for diagnosing

* Some methods for statistical handling of data where matched "controls" are used in studies of this type are described in reference 10.

† Preliminary reports from the National Health Survey have indicated that it may be possible to secure higher response rates in some areas. Continued methodological investigation is being undertaken.

disease change. The decision to make an epidemiological study ordinarily implies that there are available sufficiently precise methods of diagnosis to permit the identification of cases of disease under study. In this respect, the study of hypertensive and atherosclerotic cardiovascular disease is beset with serious problems for lack of objective criteria for identification. The evaluation of blood pressure level is difficult enough, but even granting a reliable pressure evaluation, there appears to be little unanimity as to the other measurable characteristics which should be assessed in order to classify a person into the groupings "hypertensive disease" or "not hypertensive disease." Similarly, with respect to coronary artery disease, while the evaluation of the frank coronary attack can undoubtedly be made with relative precision, there appear to be no adequate methods for estimating the extent of advancement of the underlying atherosclerotic process. In longitudinal studies, as well as in clinical experience, a significant proportion of subjects found to experience frank coronary events have been classified as apparently free of disease at examinations not long before the event. Cross-sectional studies miss such cases entirely.

The existence of this problem has led to what might be called the Substitution Game in which "blood pressure level" is substituted for "hypertensive disease" or "serum cholesterol level" for "coronary artery disease." It would appear that these substitutes can at best be only crude indexes of the diseases which it is desired to study and their uncritical use may obscure important relationships.*

It seems clear that better methods of diagnosis adaptable to the needs of large-scale studies need to be developed. In any event, the methods employed in current studies should be explicitly described, and knowledge of their limitations should be taken into account in interpreting results.

B. *Validity of Measurements*

A measurement procedure is valid if it measures what it purports to measure; a procedure is reliable if it gives the same results when used repeatedly in the same situation (i.e., when it is reproducible). A measurement procedure may be valid even though its reliability is low; a highly reliable (or reproducible) procedure may be of low validity.

The validity of a measurement, whether of the existence of disease or of some characteristic of an individual (physiological, biochemical, environmental, and so forth) is relative; validity is often judged qualitatively, but should be quantified whenever possible. For example, a given ponderal index based on some ratio between weight and height may be considered a good index of fatness, but can be checked against the more nearly exact measure of underwater weighing. Two-stage sampling is useful in checking the validity of a convenient, relatively inexact test applied to an entire study group by subsequently applying a finer but less convenient measure to a subsample.

C. *Reliability (Reproducibility) of Measurements*

There are two factors which affect reproducibility of biological measurements—variability in the measurement process itself and individual biological variability. The former can often be controlled to some extent provided that the investigator is forewarned of its existence by routine reproducibility studies. An investigator can rarely control individual biological variability;

* It is not intended to imply that the descriptive epidemiology of blood pressure or cholesterol levels will be unprofitable. At the present stage of knowledge such studies may make valuable contributions to the understanding of disease.

he can only reckon with it in his analysis, but, again, only if he has adequately evaluated it.

Every study should make some provision for tests of reproducibility of at least selected types of measurements on samples of subjects throughout the course of the study. The essential factor in such tests is the independent application, by two or more persons, of the same procedure to the same object of study, whether the object of study be a specimen of serum, an x-ray film, or a subject's description of his symptoms. With advance planning, incorporation of such tests is feasible, though it is recognized that tests of particular kinds of measurements are time-consuming, costly, and not without technical problems in execution. An attitude of unquestioning confidence in procedures customarily used may be a major obstacle. It would be desirable to establish agreed upon "tolerance levels" of measurement error for those measures common to epidemiological studies in the cardiovascular field.

Individual biological variability is much more difficult to evaluate than simple laboratory reproducibility, yet it may be much more important in intra-individual comparisons in longitudinal studies. There is need for more complete documentation of individual variability for many widely used measures, and in some instances this will require the setting up of special studies. The committee notes that other committees of the conference have considered this problem in their reports.

D. *Minimum Base Line Measures and Standard Methods of Presentation*

The committee believes that the epidemiological study of cardiovascular disease will be more productive if steps are taken to secure a greater degree of comparability between the studies which are being carried out by investigators in different population groups. One requirement for comparability is agreement among investigators to include in each study a specified minimum set of measurements to be carried out under standard specifications. A second requirement is that published reports of studies present these minimum data in some standard format. (Alternatively, it could be agreed that standard tabular material be deposited with the American Documentation Institute with the deposit noted in the published report.) The committee believes that the progress made by the other committees of the conference toward agreement on standard patterns in several areas of investigation is evidence that these aims are achievable, and that they can be achieved without putting any undue burden on the individual study or restricting the freedom of the individual investigator. The committee recommends that the sponsoring organizations consider setting up a continuing group to make recommendations in these areas, and to subject these recommendations to periodic review and revision as required by changing developments in the field.

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COMMITTEE ON CRITERIA FOR DIAGNOSIS OF DISEASE AND CLINICAL EVALUATION

Joseph T. Doyle, M.D., Chairman

SUBCOMMITTEES ON CLINICAL EVALUATION, BLOOD PRESSURE MEASUREMENT, AND ECG INTERPRETATION

THIS report summarizes the deliberations of three subcommittees which considered the definition and the clinical evaluation of ischemic heart disease and of hypertensive disease; the use of electrocardiography in epidemiologic studies; and the measurement of arterial blood pressure. An attempt is made to offer realistic recommendations concerning diagnostic methods. The numerous lacunae in our knowledge of degenerative heart disease are urgent indications for further research. The committee feels that epidemiologic surveys offer an unusually good opportunity for research in many levels and strongly recommends that such opportunities be exploited.

Epidemiologic studies are concerned with the incidence and prevalence of diseases in population groups rather than in individuals. The occurrence of disease is then correlated with other characteristics of the populations. What is needed is a reliable index of disease which will identify the same proportion of cases of disease in various populations, rather than a method of locating every single case of disease. An objective method such as electrocardiography, which is relatively free from falsifying factors, can give a better index of disease rates than the subjective manifestations of the anginal syndrome, which may identify larger numbers of cases but are affected by individual differences unrelated to the disease being studied.

Ischemic Heart Disease

Definition—Consistent with the recommendation of the World Health Organization Study Group on Atherosclerosis and Ischemic Heart Disease the term "ischemic heart disease" will be used. The definition is as follows:

> "Ischemic heart disease" is defined as the cardiac disability, acute and chronic, arising from reduction or arrest of blood supply to the myocardium in association with disease processes in the coronary arterial system. The two main pathological processes involved are (a) atherosclerosis of, and (b) thrombosis in, these vessels. The same processes may be responsible for atherosclerotic and ischemic cerebral and peripheral vascular disease. . . ."[1]

The "classification" recommended by the WHO Expert Committee on Cardiovascular Diseases and Hypertension is endorsed with a number of modifications which are contained in the following extract.[2] The principal manifestations and clinical syndromes of ischemic heart disease are as follows:

1. Myocardial Infarction

(a) Definite Myocardial Infarction —A disease due to obstruction of the coronary circulation and causing necrosis of a macroscopic, circumscribed area of myocardium. Such an area will, if death does not ensue, undergo fibrosis. The well known signs and symptoms of acute myocardial infarction will rarely be encountered in field studies. The diagnosis of previous acute myocardial

infarction is based on these two features:

(i) History—A clear history, given by the patient, of the sudden, less often of the gradual, onset of severe chest pain or discomfort, usually at rest and located as in anginal syndrome (2a below), frequently associated with vasomotor collapse and often requiring prolonged bedrest. If the patient was hospitalized, the information obtained from hospital records should be separately entered so as not to bias comparisons with results from areas where such information cannot be obtained.

(ii) Electrocardiogram — Serial electrocardiograms taken during the acute phase of myocardial infarction are usually conclusive evidence of the lesion. The electrocardiogram often reveals stigmata strongly suggestive of or diagnostic of old myocardial infarction. An example of some tentative criteria for the recognition of old myocardial infarction is given in Appendix A. Technical aspects of electrocardiography are discussed in a subsequent section of this report.

(b) Possible Myocardial Infarction —The history is not as clear-cut as in definite myocardial infarction but includes pain or discomfort similar in location but more intense and/or of longer duration than in anginal syndrome (see 2 below). The electrocardiogram is not normal but is not typical of definite myocardial infarction.

2. Anginal Syndrome—It has been argued against the use of this syndrome that it is entirely subjective and depends on the observed and the observer. It is felt, however, that the manner in which the patient describes anginal pain is so characteristic that it cannot be considered only subjective, and warrants the diagnosis of anginal syndrome as a subclassification of ischemic heart disease. Due care must be taken to recognize the exclusion categories (see 2c below).

(a) Definite Anginal Syndrome—A discomfort or pain, occurring across both sides of the anterior chest wall or located centrally in the sternal region, brought on by effort, e.g., exercise, emotion, exposure to cold and wind. It may radiate to the left arm or both arms, the shoulders, the neck, or jaw. It is spontaneously described as "pressing," "tight," "heavy," "constricting" or "crushing," or as "numbing" or "burning." It is usually relieved within a few minutes after cessation of effort or of taking sublingual nitroglycerine. Cases of angina at rest will rarely be encountered in field studies.

(b) Possible Anginal Syndrome—

(i) Discomfort or pain as in definite anginal syndrome, but beginning in any of the sites of radiation mentioned.

(ii) Discomfort or pain as in definite anginal syndrome, but commencing in the left or right anterior chest or in the epigastrium.

(iii) Discomfort or pain as in definite anginal syndrome which may subside despite continued effort.

(c) Exclusion Categories—

(i) Discomfort or pain as described above occurring after cessation of effort as contrasted with discomfort occurring during effort, e.g., in anxiety states.

(ii) Discomfort or pain as described above occurring only in relation to meals and posture, e.g., hiatus hernia.

(iii) Discomfort or pain as described above but related only to special movements and positions of the body, e.g., arthritis, fibrositis.

(iv) Stabbing or lancinating pain in the region of the left breast, e.g., in anxiety states.

(v) Localized or general chest and/or arm discomfort or pain due to thoracic outlet or hyperabduction syndrome.

3. Sudden Death—At the present time there is insufficient quantitative evidence to justify the use of sudden death as an index of the frequency of ischemic heart disease. Except for special studies this term should be used in the sense of instantaneous death. Sudden death should become a useful index if quantitative estimates can be obtained, in unselected populations, of the relative numbers of deaths due to ischemic heart disease and to other vascular catastrophes. This problem is considered in detail in the Report of the Subcommittee on Morphology.

4. Congestive Heart Failure—A complex syndrome manifested by dyspnea, diminished exercise tolerance, pulmonary congestion, water and salt retention, hypervolemia, venous hypertension, splanchnic congestion, and peripheral dependent edema. In the absence of other etiologic factors it is often assumed that congestive heart failure is due to diffuse myocardial damage caused by coronary artery occlusion. This assumption is unfounded. Chronic heart failure cannot, therefore, be considered a reliable index of ischemic heart disease.

The following comments were made by the committee on diagnostic methods:

1. History—In the absence of any other information it must be assumed that a history of anginal syndrome or past myocardial infarction can be reliably obtained only by a physician. There is no information concerning the reproducibility or the reliability of such histories taken by physicians of varying levels of training and experience. It must also be conceded that the accuracy of a history of ischemic heart disease obtained by a specially trained lay interviewer has never been evaluated. This possibility deserves intensive investigation for use in epidemiological studies. There is sufficient experience with self-administered questionnaires to condemn their use in field studies.[3]

2. Physical Examination—There are no readily discernible abnormalities characteristic of ischemic heart disease. It is, however, possible to detect evidence of atherosclerotic obliteration of other vascular territories, such as in the brain, retinal vessels, and the lower extremities. This information may be epidemiologically just as important as evidence of ischemic heart disease.

3. Electrocardiogram—It is a truism that the electrocardiogram does not identify atherosclerosis but only its myocardial ischemic complications. A majority of individuals with the anginal syndrome exhibit normal resting electrocardiograms.[4] An unknown number of individuals recover from acute myocardial infarction with no residual electrocardiographic abnormalities or with intraventricular conduction defects not usually ascribed to myocardial infarction.[5]

There is increasing indication that an abnormal electrocardiographic response to stress is valuable evidence of ischemic heart disease. If time and budget permit, and if adequate medical supervision is available, it is suggested that an electrocardiographic stress test be incorporated in some epidemiological studies. It must be recognized that such tests carry a small but definite risk. The diagnostic criteria of an abnormal electrocardiographic response to exercise proposed by Robb and Mattingly are endorsed.[6]

Hypertensive Disease

The following appears to be a satisfactory definition of the hypertensive process:

> The term hypertensive disease is synonymous with essential hypertension and should properly be restricted to designate the as yet unidentified physiological disturbance (or disturbances) characteristic of this disease and which leads ultimately to elevation of diastolic and systolic blood pressures, anatomical changes in the vascular tree, and functional impairment of the involved tissues. Hypertension is the earliest clinically recognizable disturbance and results from constriction of the peripheral arterioles, this constriction leading to an increase in the total effective peripheral resistance and hence to elevation of diastolic and systolic blood pressures. Hypertensive disease is considered to be a clinical entity on which an unknown pressor mechanism initiates arteriolar vasoconstriction, elevated blood pressure and vascular sequelae. Hypertension, as such, like arteriolar changes, is conceived to be a sequela appearing during the progressive development of the disease.[7]

Blood Pressure Criteria—It is advocated that cumulative frequency distributions and curves be used to report the

levels of arterial blood pressure found in any defined population; these provide the best way of comparing populations. It is recognized that clinical usage demands arbitrary criteria of normal and of abnormal arterial blood pressure. The following criteria are, therefore, suggested as a supplement to but not as a substitute for cumulative frequency curves. The proposed numerical values can obviously be adjusted to suit the needs of any particular investigator.

(a) Normotension—Systolic blood pressure below 140 mm Hg *and* diastolic blood pressure below 90 mm Hg, i.e., *both below*.

(b) Hypertension—Systolic blood pressure 160 mm Hg or over, or diastolic blood pressure 95 mm Hg or over, i.e., either one or both at or above the specified levels.

(i) Systolic Hypertension—Systolic blood pressure 160 mm Hg or over *and* diastolic blood pressure *under* 90 mm Hg.

(ii) Diastolic Hypertension—Systolic blood pressure *under* 140 mm Hg and diastolic blood pressure 95 mm Hg or more.

(c) Borderline Hypertension—This is the residual category, i.e., the systolic blood pressure is below 160 mm Hg *and* the diastolic blood pressure is below 95 mm Hg, but they are not simultaneously below both 140 mm Hg systolic and 90 mm Hg diastolic. Note that the diagnosis of hypertension is based on "either-or" criteria, while normotension requires that both the systolic and the diastolic readings be below the cutting points.

When multiple determinations are made, the assignment should be based on the first determination or on the mean.[8]

The following general statements can be made concerning *clinical evaluation* of participants in epidemiological studies:

1. Hypertensive Disease, Uncomplicated—As the term implies, consistently elevated arterial blood pressure is the only deviation from normal. No symptoms characterize this phase. Complete clinical evaluation requires the exclusion of visceral involvement and of causes of secondary hypertension. Since secondary hypertension is rare it would seem unnecessary in epidemiological studies to make special efforts to identify such cases.

2. Hypertensive Disease, Complicated—This term implies visceral involvement which, depending on the degree of organ compensation, may or may not be characterized by symptoms. The vascular territories most commonly affected by the hypertensive process are in the heart, the brain and the kidneys. Marked elevations of the diastolic blood pressure accelerate and aggravate atherosclerosis.[9] The definition of hypertensive heart disease is inevitably circular since it is dependent on the demonstration of what is considered to be an abnormally elevated blood pressure associated with signs and ultimately symptoms of an increased left ventricular work load. In many instances the visceral complications of hypertensive disease may be due to ischemia consequent to atherosclerotic-thrombotic vascular occlusion. The following clinical and laboratory procedures are suggested for field use:

(a) Heart—History and physical signs of (paroxysmal) left ventricular failure. Radiologic evidence of early left ventricular enlargement is notoriously unreliable. Electrocardiographic evidence of early left ventricular enlargement is likewise unreliable. Large QRS voltages in youth and early adult life cannot be accepted as testimony of left ventricular enlargement. There is poor correlation between the x-ray and the electrocardiogram in early left ventricular enlargement.

(b) Brain—History of or neurological residua of a previous cerebrovascular accident. History of hypertensive encephalopathy. Retinopathy: fundoscopy is entirely feasible in the field and should at least distinguish normal or mildly abnormal eyegrounds from grossly abnormal, employing the Keith-Wagener classification.[10] Under some circum-

stances it may be possible to take fundal photographs as an objective record.

(c) Kidneys—There are no satisfactory field methods for estimating renal function. If orthostatic proteinuria be excluded, proteinuria is reliable evidence of renal functional impairment. Microscopic examination of the centrifuged urinary sediment is desirable. Cylindruria may be taken as evidence of renal tubular damage. Pyuria in the male is prima facie evidence of genitourinary infection.

3. The Prehypertensive State—The existence of this phase is theoretical. There is no evidence that a labile arterial blood pressure necessarily presages later hypertensive disease.[11] Tests for vascular hyperreactivity such as the cold pressor test are of no particular diagnostic value and are of unknown prognostic significance due to lack of prolonged follow-up data.[12]

Notes on Technical Methods

I. Measurement of the Arterial Blood Pressure

Instrumentation—The "Recommendations for Human Blood Pressure Determinations by Sphygmomanometers" sponsored by the American Heart Association are strongly endorsed,[13] with the exceptions noted below.

It is felt that the following items merit emphasis. It is recommended that a cuff 12-14 cm in width be used; the cuff should be so designed that closure and inflation will exert uniform tension over the whole width of the cuff. Where large numbers of measurements are to be made in a short time, consideration should be given to the use of a pressure reservoir to inflate the cuff. The mercury manometer is the standard of calibration. The zero should be clearly visible; the upper end of the glass tube should be freely vented. Aneroid manometers are acceptable if checked frequently (every few days) against a mercury column. The tendency of observers to round off manometric readings is recognized. It is suggested, nonetheless, that the observer read the scale to the nearest even number. Objective, automatic methods of measuring and recording the arterial blood pressure should be well within current technical capability and are highly desirable to avoid the problem of observer bias. Despite the official recommendation that the arterial diastolic pressure be taken as the point of disappearance of the Korotkow sounds, there is substantial evidence that the point at which the Korotkow sounds become muffled may correspond more accurately with the true diastolic pressure.[14-16] It is, therefore, recommended that both points be routinely recorded. For the present, the point of disappearance of Korotkow sounds should be used as the diastolic pressure for statistical purposes.

The Observer—It is self-evident that if the auscultatory method of sphygmomanometry be used, the observer must have adequate hearing. It is suggested that in epidemiological studies the observer should present a normal complete audiogram as a preliminary qualification. An acoustically acceptable stethoscope should be used. It would be highly desirable for the examiners in all population studies to practice together on the same subject until a satisfactory uniformity of blood pressure measurement had been achieved. It would likewise be highly desirable for similar inter-study comparison to be made. To both these ends it is hoped that audiovisual training devices may soon be fabricated. The clinically traditional use of cutoff points to discriminate between normal and abnormal levels of blood pressure inevitably creates observer bias as evidenced by anomalies in life insurance statistics and the universal tendency of numerical values for the diastolic blood pressure in particular to cluster at certain points.[17] This problem is so acute that serious consideration might

be given to the use of offset manometer scales to give a spurious reading later decoded by the statistician. Provision should be incorporated in all studies to code the observer so that the source of possible systematic deviations may be identified. Since, however, the level of the arterial blood pressure may normally fluctuate widely;[18] since almost all proposed criteria distinguish between diastolic normotension and diastolic hypertension on differences of only a few mm Hg; since, as previously noted, the indirect measurement of diastolic blood pressure is uncertain, unreliable, and subjective; and since there is no predictable association between the level of the arterial blood pressure and the presence of vascular damage, the abandonment of arbitrary and rigid cutoff points to discriminate between normal and abnormal levels of arterial blood pressure is advocated. It is felt that proper training and sound motivation are more important than the professional background of the individual who measures arterial blood pressure in population surveys.

The Observed—It is probable that the casual blood pressure is most often measured with the subject in the seated position. The arm must be at the same level as the heart. There may be some advantage to measuring the blood pressure when the subject is supine, since the arm is then at heart level and orthostatic hypotensive influences, often exaggerated by antipressor and other drugs, are abolished. The diastolic pressure is less affected by changes in posture. The systolic pressure may, however, be considerably affected by change in posture so that five minutes should elapse before it is measured.[19] More comparative measurements of the arterial blood pressure in the supine, sitting, and even standing positions are required. The minimum clinical data that should be recorded include the sex, age, height and weight, and pulse rate of the subject. Most hypertensives under treatment seem to be ignorant of the exact nature of their medication. It seems, nonetheless, desirable to inquire of all subjects whether medication is being taken and to record whatever information is elicited. The extent to which obesity of the upper arm may invalidate the indirect measurement of the arterial blood pressure is not completely known. For this reason it would be worth while when feasible to make a comparative measurement of blood pressure in the forearm.[20,21] No definitive statement is possible on the optimal number of blood pressure measurements to be taken. There is some evidence that when taken in rapid (30 second) sequence there is a successive decline of the second and third readings, and that the third reading is fairly representative of those made subsequently. When multiple measurements of the arterial blood pressure show reasonable consistency, the use of average values for statistical purposes is probably valid.

II. Electrocardiography

The Electrocardiogram—The electrocardiogram is an objective record of bioelectrical phenomena. Strictly speaking, anatomic inferences should not be based on this record. Practically, the diagnostic interpretation should be made only after collation of all clinical data.

The ECG plays a small and uncertain role in epidemiologic studies of cardiovascular disease. For example, in atherosclerosis, it will confidently identify only that small per cent of cases of coronary artery atherosclerosis where frank myocardial infarction has taken place. Criteria for identifying normal from abnormal QRS items are reasonably reliable in many instances, with the notable exception of QRS criteria for left ventricular hypertrophy. S-T and T criteria for normal and abnormal are much less reliably known. The

committee is of the opinion that while large ECG surveys may usefully lend themselves to identifying the "normal" versus "abnormal" ECG, they do not lend themselves reliably to identifying specific diseases. Furthermore, while criteria for the normal ECG are reasonably reliable in the age range 40-60 years, other age groups have not yet been adequately studied in this regard.

Direct-writing electrocardiographs are suitable for population surveys, but should be frequently checked to insure the accuracy of paper speed and of calibration voltage, stylus cleanliness, centering and excursion, vacuum tube stability and so forth. Standard electrode jelly or paste should be used as the electrolytic contact agent, although plastic electrode jelly is acceptable.

Lead Selection—Informal polls indicate that electrocardiographers consider the 12 lead (three bipolar and three unipolar limb leads and six or seven precordial V leads) electrocardiogram the diagnostic standard. There is, however, no evidence that the 12 lead electrocardiogram is essential to adequate diagnosis. No more information is contained in unipolar than in bipolar limb leads, or vice versa. Conventional precordial lead placement is arbitrary and presents no intrinsic merit save that of general usage. Indeed, the placement of precordial leads at the three, four, and five positions is subject to anatomical variation and particularly to technician error. The potential gains in ease, speed and money commend the study of the value of limited numbers of electrocardiographic leads.[22-27]

The Electrocardiographer—Conventional training in electrocardiographic interpretation requires an apprenticeship of a year, while competence can be maintained only by continuing experience. Relatively little is known on either an individual or a group basis of the accuracy, reproducibility and reliability of electrocardiographic interpretation. If large population studies are to be conducted these questions must be answered. In addition, means must be devised to cope with the enormous numbers of electrocardiograms taken in such studies. Unquestionably, a competent electrocardiographer could rapidly and accurately sort electrocardiograms into normal, borderline, and abnormal groups up to the limits imposed by fatigue. It is felt that intensive investigation should be made of the problem of developing generally acceptable criteria of electrocardiographic interpretation simple enough but yet sufficiently accurate to be used effectively by a physician or by a technician not specially trained in electrocardiography. The use of simplified improved lead systems is particularly germane to this problem. If, as seems likely, electronic computers come to be used more commonly in biological investigation, the development of suitable electrocardiographic diagnostic criteria will be essential to intelligent programming of such instruments. The Laboratory of Physiological Hygiene of the University of Minnesota, with these purposes in view, has devised a set of criteria for the electrocardiographic diagnosis of myocardial infarction (Appendix A).

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APPENDIX A

Excerpt from Classification of the Electrocardiogram for Epidemiological Studies*

This excerpt is presented as an example of the kind of criteria for old myocardial infarction which can be constructed, based on electrocardiographic surveys of large groups of persons. The examples pertain to resting electrocardiograms taken in the supine position on adults under the age of seventy. Further information about the complete classification can be obtained from the authors.

A. QRS Criteria Type I (Myocardial Infarction)
(Q must be 1 mm or more to be designated as such.)

1. Q/R ratio of ⅓ or more in any of leads I, II, V_2, V_3, V_4, V_5, V_6; or, if the transition zone is to the left of V_5, in lead V_1.
2. Q wave duration of 0.04 second or longer in any of leads I, II, V_1, V_2, V_3, V_4, V_5, V_6; and, if R is plus 3 mm or more, in aVL.
3. Q wave duration of 0.05 second or longer in lead III or if R is plus 3 mm or more, aVF. (Some Q must be present in aVF.)
4. QS pattern (absent R wave) in any of leads V_2 through V_6 when an R wave is present in the adjacent precordial lead to the right.

B. QRS Criteria Type II
(Q must be 1 mm or more to be designated as such.)

1. Q/R ratio of ⅕ to ⅓ in any of leads I, II, V_2-V_6, or if right ventricular hypertrophy is not present, in lead V_1.

* Prepared by Henry Blackburn, Ernst Simonson, Ancel Keys, et al., Laboratory of Physiological Hygiene, University of Minnesota. The complete criteria include most electrocardiographic abnormalities of importance for epidemiological studies.

2. Q wave duration of 0.03 to 0.04 second (in any of leads I, II, V_1-V_6, and if R is plus 3 mm or more in aVL).
3. Q wave duration 0.04 to 0.05 second in leads III or aVF. (Some Q must be present in aVF.)
4. Q amplitude of 5 mm or greater in leads III or aVF when an R wave is present.
5. QS pattern in V_1-V_2 in the absence of left bundle branch block and left ventricular hypertrophy.

SUBCOMMITTEE ON MORPHOLOGY

David M. Spain, M.D., Chairman

Introduction

THIS report presents the combined effort of the committee and the conclusions represent complete agreement among the members of the committee. It is particularly worthy of mention that basic agreement was rapidly reached in all major aspects of this report. Comparison with the conclusions reached by the WHO Study Group on Atherosclerosis also reveals major similarities with this committee's conclusions. The recognized difficulty in epidemiologic studies on coronary atherosclerosis in live population groups is the inability to obtain precise measurements of the degree of atherosclerosis that may be present in any of the individuals studied. In autopsy studies, this difficulty is to a great extent eliminated, but studies on autopsy populations suffer from lack of ability to properly generalize the findings to the population as a whole. Nevertheless, it is believed if comparable postmortem methods are used in different areas of the world, a valuable contribution may be made to further the understanding of the pathogenesis of this disease.

Definitions

The definition of the atherosclerotic lesions to be measured was similar to that agreed upon by the WHO Study Group in 1958. This definition is as follows:

"Atherosclerosis is a variable combination of changes of the intima of arteries consisting of focal accumulations of lipids, complex carbohydrates, blood and blood products, fibrous tissue and calcium deposits, and associated with medical changes."*

The lesions to be considered within this classification may be subdivided or classified in several different ways. The manner of subclassification is less important than the preciseness and clarity of the definitions. Some will classify the various lesions into fatty or lipid streaks, fibrous plaques, atheroma and complicated lesions. The complications include hemorrhage into the lesion, superimposed thrombi, ulceration, and calcification. Others suggest that the lesions be divided into lipid streaks, fibrous plaques, complicated lesions, and calcifications; definitions of these classes of lesions are given in Appendix A. Listing of these lesions in the above order does not necessarily imply any exact biological sequential relationship. It is also understood that the term "fibrous plaque" does not preclude the presence of lipid complexes within its depths. The importance of defining and

* Classification of Atherosclerotic Lesions. (Report of a Study Group). WHO Tech. Rep. Ser. No. 143, 1958.

subclassifying these lesions resides in the fact that in any measurement or grading system, the lipid streaks should at least be clearly delineated from the others.* In measuring the surface area of involvement in the aorta or coronary artery, 40 per cent involvement with only lipid streaks may have an entirely different significance than a similar degree of surface involvement with any combination of the other classes of lesions.

Vessels to Be Studied

The coronary arteries and aorta should be examined in every instance. It is not feasible to consecutively study the cerebral vessels because, in this country at least, post-mortem permission for such examination is often not obtained. There are also greater technical difficulties for making measurements of the degree of atherosclerosis that would interfere with a reasonable ability to compare one study with another. It is not sufficient to either examine the coronary arteries or the aorta alone. The findings of the degree of atherosclerosis in a series of aortas do not necessarily parallel those in the coronary arteries. Sex, race, age, and geographic differences also affect comparability of the degree of atherosclerosis in the aorta with the amount of atherosclerosis in the coronary arteries (see Table 1). Therefore, as a minimal objective, in order to obtain a more meaningful over-all picture, at least both vessels should be studied. Where routine and consecutive brain examinations can be made, and where sufficient attention can be given to the proper examination and grading of cerebral atherosclerosis, it is of course highly desirable to do so. Any such study on cerebral atherosclerosis, however, must take into account the fact that cerebral ischemia may develop as a result of atherosclerosis in carotid artery branches entirely external to the skull, while the intracerebral vessels may show comparatively little change.

The examination of other vessels in a piece-meal fashion, such as mesenteric arteries or renal arteries, would not contribute any significant information to the over-all picture. At present, legal, religious, and embalming obstacles preclude the possibility of routine examination on all the major vessels of the body.

Preservation and Records

The conditions under which examination and grading of the vessels are conducted will determine to a great extent the objectivity, accuracy, and comparability of the findings. Whether or not the specimens should be examined in a fresh or fixed state will depend upon the particular circumstances under which the study is being conducted. Whichever the method, it should be consistently employed throughout the study because there is evidence to indicate that variations in grading, particularly as regards coronary arterial luminal size, exist between the fixed and unfixed state in the same specimen. Provision should be made for preservation and semipermanent storage of the vessels. A practical method utilized by one member of this committee is excellent for this purpose.† Permanent storage of the vessels is not always feasible because of expense, personnel, and time-consuming effort involved. In any event, the findings should always be reduced

* Strong, J. P.; McGill, H. C. Jr.; Tejada, C.; and Holman, R. L. The Natural History of Atherosclerosis: Comparison of the Early Aortic Lesions in New Orleans, Guatemala, and Costa Rica. Am. J. Path. 34:731–744 (July-Aug.), 1958.

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Table 1—Relative Degree of Atherosclerosis in Aorta and Coronary Arteries in Consecutive Autopsies of Sudden Death (M.E. Cases) from Natural or Accidental Deaths

	Total Cases	A>C	A=C	A<C
Age group, 30-50 years				
Females	76 (100%)	32 (42%)	28 (37%)	16 (21%)
Males	147 (100%)	11 (7%)	49 (34%)	87 (59%)
Age group, 51-70 years				
Females	72 (100%)	26 (36%)	28 (39%)	18 (25%)
Males	165 (100%)	35 (21%)	61 (37%)	69 (42%)

A>C: Aorta has a relatively greater degree of atherosclerosis than coronary arteries.
A=C: Aorta has an equivalent degree of atherosclerosis to that of coronary arteries.
A<C: Aorta has a relatively lesser degree of atherosclerosis than the coronary arteries.
(Spain, D. M., and Bradess, V. Unpublished data from Westchester Medical Examiner Coronary Study.)

to some form of schematic diagram which can be permanently kept. The elaborateness and detail of such a diagram will vary with the needs and design of the particular study. (Examples of simple and more detailed diagrams are listed in Appendixes B-1, B-2, and C.)

Examination of the Vessels

The examination, interpretation, grading, and measurement of the lesions in the vessels should be performed by competent pathologists well versed in the various lesions of atherosclerosis. Preferably one examiner should carry out the entire study. When this cannot be done, a team of examiners should be trained in advance so that their measurements cross-check with each other in order for the findings to be reasonably consistent and reproducible.

Unbiased grading is difficult in the absence of a coding system. Sometimes the situation demands that a specimen be examined immediately at the site of autopsy. In such situations it is sometimes impossible to conceal age, sex, race, and so forth. But, when possible, the project should be so designed that the grading and examination can be determined on completely coded material.

The method of grading lesions depends to some extent on the technic employed in dissecting the vessel. The standard methods of examining coronary arteries—cross-sectional cuts or longitudinal dissection—are acceptable. If the cross-sectioning method is used, these should be performed at intervals no further than 3 mm apart. It is recognized that the WHO report suggests a 5 mm difference as being sufficient, but it requires very little extra effort to reduce this interval and, in the experience of some, an interval as wide as 5 mm can miss a significantly large number of thrombi or occlusive atherosclerotic plaques. In the longitudinal method the vessel is opened as far as possible with small coronary dissecting scissors. The quantity and quality of the surface area involved is then recorded. The three major coronary vessels must be examined.

The aorta should be examined by a lengthwise opening and then spread flat. The entire aorta should be described, but for grading purposes the surface area between the upper margin of the first intercostal artery orifice and the bifurcation into the iliacs should be

considered. Some have recommended that the circumference of the aorta should be measured at various levels. This information would not appear to contribute to the solution of any of the desired objectives and would only add unnecessary details to the examining procedure.

Grading

It matters little as to what terminology is used in the grading method, provided the terms are clearly defined within an accurate and clear frame of reference. If this procedure is followed regardless of the terminology employed, the results of one study may then be reasonably compared with those of another. The grading in the coronary arteries may take into consideration segments of stenosis, mean or maximum diminution in lumen size, the extent of surface involvement and the types of lesions present. If one excludes flat lipid streaks, there is considerable evidence which indicates that the mean luminal diameter relates closely to the extent of surface area involvement. In a study at the Albany Hospital, under the auspices of the Albany Medical School and the New York State Department of Health, it has been found that the curves for mean wall thickness and small lumen size parallel each other very closely. Also each measurement bore a similar relationship to the incidence of myocardial infarcts in both sexes. It is generally agreed that if either the degree of surface area of involvement of the coronary arteries or the maximum area of lumen reduction is used as a method of grading, the end results should be similar. There has been needless concern over the number of individuals who may have isolated segmental occlusive plaques in the coronary artery tree, in the absence of any significant degree of more widespread atherosclerotic involvement. This occurs usually in young individuals, is uncommon and is often found in association with an anomalous coronary arterial circulation or underlying inflammatory lesions of the vessel wall. These occasional cases cannot materially influence the findings in any large-scale autopsy studies. Grading may be in terms of moderate or severe, in terms of pluses or in percentage, but these must always refer back to clearly defined limits or categories.

In the recording system the distribution and extent of the different types of lesions should be indicated wherever possible. As for the aorta, the degree of surface area involvement should always be recorded with attention given to the distribution and relative proportion of the various types of lesions.

Thrombi and Intimal Hemorrhages

There is a problem at times of differentiating organized thrombi in the coronary arteries from atherosclerotic plaques. For recent thrombi, this is relatively simple. For remote and organized thrombi this is difficult and in many instances not possible. Canalization of the lesion was considered as possible evidence in favor of an old organized thrombus, as opposed to an atherosclerotic plaque, but this is by no means conclusive. However, such errors that would arise in the grading and classification of lesions relative to this difficulty should not significantly influence the validity of the findings. Most evidence indicates that the more extreme and older coronary atherosclerotic lesions are associated more frequently with superimposed thrombi (see Table 2).

The gross recognition and recording of intimal or intramural hemorrhages as a routine in any large-scale autopsy study can serve no meaningful purpose and may lead to erroneous conclusions. Proper study of intimal hemorrhages re-

Table 2—Frequency at Various Age Levels of Recent Thrombi in Sudden Death in White Males with Advanced Coronary Atherosclerosis (377 Autopsied Cases)

	Age in Years			
	Under 39	40-49	50-59	60-69
Number of cases with advanced coronary atherosclerosis (total)	46	116	126	89
Number of cases with recent superimposed thrombi	5 (11%)	26 (22%)	30 (24%)	25 (29%)

(Spain, D. M., and Bradess, V. Unpublished data from Westchester Medical Examiner Coronary Study.)

quires meticulous attention to detail with serial microscopic sectioning, clearing technics, and so forth. These procedures can generally not be performed with the minimal methodology available for large-scale studies. This view is in no way meant to underestimate the desirability and potential significance of studying the problem of intimal hemorrhages. This might very well be performed as a special investigation within a limited segment of an overall larger study.

Other Technics

Microscopic studies do not contribute enough additional information to significantly improve the exactness of the grading process to be required as a routine procedure. Such technics that determine elasticity, viscosity of the vessel wall, as well as detailed chemical contents of the lesions, do not appear to enhance the accuracy of the grading procedure.

The value of an index system of grading which arbitrarily preassigns certain values to the quality of the lesions, to the extent of the involvement, etc., is open to question. Such index systems have been developed in comparing the degree of atherosclerosis in one population group of autopsies with that of another. It was the consensus of this group that such an index system which arbitrarily assigns values to certain aspects of the lesions is biologically unsound and may lead to errors. The state of our present knowledge of atherosclerosis does not as yet permit such quantitation.

Injection technics involving the introduction of radio-opaque materials into the coronary arteries or the utilization of plastic cast technics are of considerable importance for studies designed to investigate the development of collateral circulation in the coronary arterial tree. These technics, however, are unnecessary and too detailed to be performed routinely in the studies under consideration. The utilization of such technics in order to gain information on the relationship between physical activity, coronary atherosclerosis, age, and collateral circulation is important and should be encouraged.

The Heart

In order to properly evaluate the significance of the atherosclerotic lesions in the aorta and coronary arteries, it is essential that certain minimal findings in the heart be determined. The condition of the valves and pericardium should be routinely recorded, so that proper evaluation may be given to the factors that contribute to any increase

in the weight of the heart. The heart should be weighed with, at the most, only the ascending portion of the arch of the aorta attached. It is not necessary to determine or record right and left ventricular wall thickness, since such errors as the inclusion of epicardial fat or papillary muscle in the measurement and the possibility of measuring tangential cuts as well as variations in wall thickness at different levels would render comparison of results almost meaningless.

The heart may be opened and examined in the usually accepted manner whereby the course of the blood is followed and the septum is split up from the apex to the base. Preservation and proper examination of the coronary artery prevents a cross-sectional slicing technic of the myocardium from being utilized.

The presence of all recent infarcts should be recorded and should include a statement as to their size, location, and age. The classically recognized textbook description of myocardial infarction furnishes the criteria for recent infarcts. Any grossly visible scar should be recorded. In the absence of any other obvious cause for such a scar and in the presence of advanced coronary atherosclerosis, this may be regarded as a healed infarct. Microscopic confirmation of recent and old infarcts is desirable but not always essential. The condition of the coronary ostia should be noted.

Information on Autopsy Record

All autopsy records should include the age, sex, race and, if possible to authenticate, the country of birth, country of residence, duration of this residence, ethnic origins, and occupational history. The immediate causes of death as well as the basic or underlying disease process or cause of death should be recorded. Height and weight should be determined and, wherever feasible, the weight should be actually measured and not estimated. If the weight is estimated, it should be so stated. Panniculus thickness should be measured in the midline midway between the xiphoid and the umbilicus.

Another method for increasing the accuracy and completeness of hospital records for the purpose of correlating certain findings with those at the autopsy is to send trained personnel into the home of the deceased within several weeks after the death, and obtain information from close relatives about smoking, exercise, diets, and other living habits. In the Albany study this has yielded significant information and has given more meaning to the pathological findings.

Hypertension and Diabetes Mellitus

Autopsy verification of the previous existence of hypertension and/or diabetes mellitus would be highly desirable. Unfortunately, there are no certain morphologic findings for both conditions—positive or negative—to prove that these did not exist. The presence of definite myocardial hypertrophy (predominantly of the left ventricle), the absence of any other cause for this hypertrophy in combination with arteriolar changes, particularly of the kidney, is strongly suggestive evidence that hypertension was present at some time during life. The presence of intercapillary glomerulosclerosis is strong evidence that diabetes mellitus was present.

Standardized Post-Mortem Examination as an Integral Part of Longitudinal Epidemiologic Studies*

A review of the various project designs of the epidemiologic studies as

* Dawber, T. R. (Ed.). Report of the Conference on Longitudinal Cardiovascular Studies at the Hotel Beaconsfield, Brookline, Mass. (June 17-18), 1957.

described in the conference at Brookline in 1957 revealed that none of these studies had included any mechanism for the gathering of standardized autopsy material. This appears to be a serious deficiency. Any procedures whereby standardized post-mortem data are collected on both sudden and hospital deaths of individuals on whom information has been obtained over many years in such studies can enhance the value of such investigations. It would seem to be rather simple to arrange for the pathologists in the involved community to set up minimal standards to obtain the necessary information relative to cardiovascular disease.

Unexpected, Unexplained, Sudden, or Instantaneous Death

In the absence of adequate clinical, laboratory, or post-mortem findings, the use of unexplained sudden death as evidence of coronary atherosclerosis with ischemic myocardial disease is at present generally not acceptable. The criteria for the classification of cases as those of "sudden death" varies considerably in different areas. Refinement of the definition of sudden deaths to include only those cases in whom there has been an eye-witness account and in whom the unexplained or unexpected sudden deaths have occurred within a matter of minutes is desirable. This group of cases should be clearly separated from those in whom the fatal event took a longer time, and from those where the individuals were found dead with no witnesses available as to the exact circumstances and their duration.

In various parts of the world, depending upon the general health and disease panorama of that area, the proportion of cases of sudden death that may be attributed to ischemic myocardial disease may vary. In this country it is highly possible that when the proper age, sex, and race factors are taken into consideration a considerable proportion of the cases of unexpected, instantaneous death where eye-witnesses were available may be ascribed to cardiovascular disease. Before utilizing this category as evidence for ischemic myocardial disease in epidemiological studies, more exact information should be obtained. A highly desirable project would be to set up a cooperative study among medical examiners' offices for the purpose of determining the proportion of unexplained instantaneous deaths that are due to coronary atherosclerosis and ischemic myocardial disease. Such a study should be relatively simple to arrange.

Biostatistical Evaluation

It is recognized that the value of any morphologic study, no matter how meticulous the method of grading, depends for the stated purposes upon the ability to relate the autopsy findings to the population group from which the autopsies are obtained. Information must also be available concerning the characteristics of those individuals, from this same population group, who are not represented in the autopsy series. Careful biostatistical evaluation and design is therefore essential and should be part of every such study. The fact that previous statistical studies have pointed to dangers in drawing conclusions from hospital autopsy studies does not preclude the proper utilization of such material for the advancement of knowledge in this field.

It is the belief of this committee that with these minimal methods of studying autopsy populations, a significant contribution toward a solution of the problems concerning the pathogenesis of atherosclerosis could be made. There is still no substitute in the understanding and solution of human disease for primary accurate observation in the human laboratory itself.

APPENDIX A

Definition of Terms

(From J. P. Strong from Protocol of Latin American Project)

Fatty Streak: Any intimal lesion that is stained distinctly by Sudan IV and that does not show any other type of change underlying.

Fibrous Plaque: Any firm, elevated intimal lesion which in the fresh state is pale grey, glistening, and translucent. After staining, it may be partially or completely covered by sudanophilic deposits. If a lesion contains any hemorrhage, thrombosis, ulceration or calicification, it will be classified under those categories and not as a fibrous plaque.

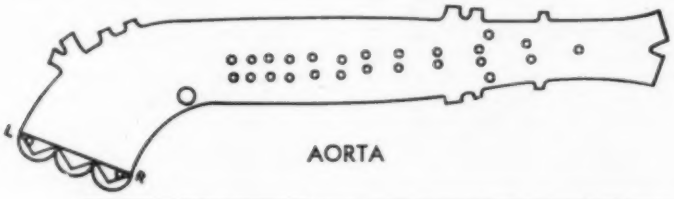
Complicated Lesion: Those areas in which there is hemorrhage, ulceration, necrosis, or overlying thrombosis.

Calcification: Areas in which there is calcium deposition detectable either visually or by palpation without overlying hemorrhage, ulceration or thrombosis.

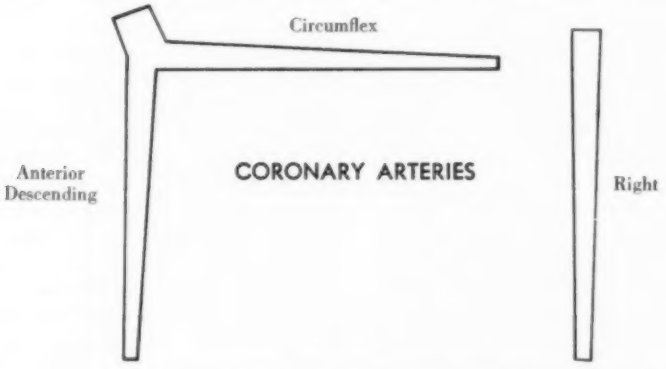
APPENDIX B-1

Preliminary Protocol of Latin American Project. McGill, H. C., and Strong, J. P., et al.

Necropsy No. _____ Accession No. _____



	Total Area Involved	Per cent of Involved Surface Composed of			
		Fatty Streaks	Fibrous Plaques	Hemorrhage, Thrombosis, Ulceration	Calcification
Descending Thoracic					
Abdominal					
Total					



	Total Area Involved	Per cent of Involved Surface Composed of			
		Fatty Streaks	Fibrous Plaques	Hemorrhage, Thrombosis, Ulceration	Calcification
Right					
Left Circumflex					
Left Anterior Descending					
Total					

APPENDIX B-2

Comparative Atherosclerosis Study

Laboratory _____ Accession No. _____

Hospital _____ Necropsy No. _____

Name _____

Age _____ yrs. Sex $\frac{M}{F}$ Race _____ Occupation _____

Country of birth _____ x _____ yrs. Country of residence at time of death _____ x _____ yrs.

Principal Final Diagnoses

Primary disease _____

Immediate cause of death _____

Other diagnoses _____

_____

_____

State of Nutrition

() unknown
() severely obese
() moderately obese
() average or normal
() thin
() malnourished

Weight _____ kgs _____ lbs

Length _____ cms

Thickness of subcutaneous fat

_____ cms

(midway between xiphoid and umbilicus

Code for principal diagnosis _____

Diseases possibly influencing atherosclerosis

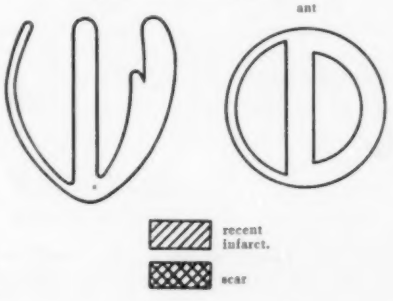
	+	−	?	
1	()	()	()	hypertension, established
2	()	()	()	hypertension, presumptive
3	()	()	()	arteriolar nephrosclerosis, benign
4	()	()	()	arteriolar nephrosclerosis, malignant
5	()	()	()	pyelonephritis, acute
6	()	()	()	pyelonephritis, chronic
7	()	()	()	glomerulonephritis, acute
8	()	()	()	glomerulonephritis, chronic
9	()	()	()	chronic renal disease, unclassified
10	()	()	()	diabetes mellitus, established
11	()	()	()	diabetes mellitus, presumptive
12	()	()	()	chronic alcoholism
13	()	()	()	portal cirrhosis
14	()	()	()	biliary cirrhosis
15	()	()	()	rheumatic heart disease
16	()	()	()	syphilitic heart disease
17	()	()	()	hypothyroidism
18	()	()	()	hyperthyroidism
19	()	()	()	other endocrinopathies:

Diseases presumably due to atherosclerosis

	+	−	?	
1	()	()	()	angina pectoris
2	()	()	()	coronary occlusion
3	()	()	()	myocardial infarction
4	()	()	()	cerebral thrombosis
5	()	()	()	cerebral hemorrhage
6	()	()	()	disabling peripheral atherosclerosis
7	()	()	()	mesenteric occlusion
8	()	()	()	aortic occlusion
9	()	()	()	aortic aneurysm
10	()	()	()	arterial nephrosclerosis
11	()	()	()	other, unclassified

Heart

Weight _____ gms



APPENDIX C

From the Westchester County Medical Examiner Coronary Artery Study. Spain, D. M., and Bradess, V. A.

Case No. M. E. No. Date
Age Sex Race Ethnic Height
Weight
Somatotype
Panniculus

Immediate Cause of Death
Circumstances

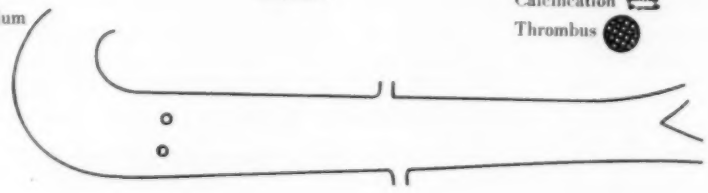
Basic Cause of Death

Occupational History

Heart:
Weight
Valves
Pericardium
Ostia
Infarcts
Location
Size
Age

AORTA

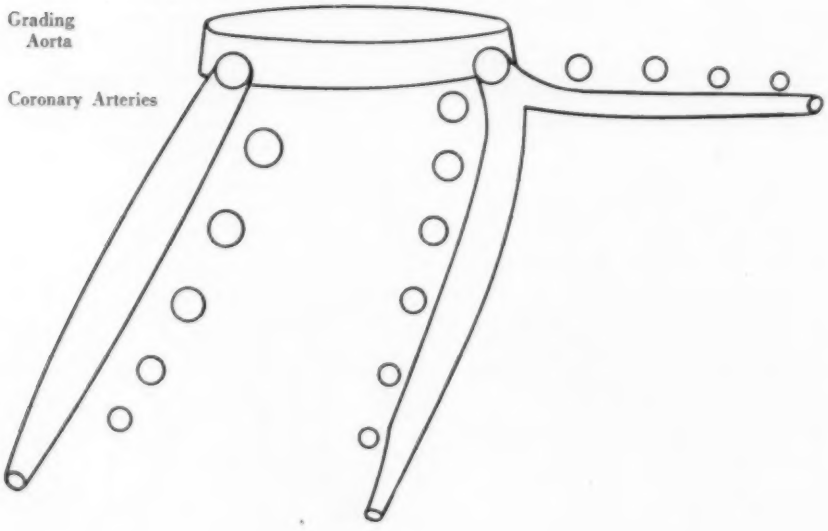
Lipid Streak
Plaque
Calcification
Thrombus



Rt. C. A. Left. C. A.

Grading
Aorta

Coronary Arteries



COMMITTEE ON DIET, PHYSICAL ACTIVITY, AND BIOCHEMICAL MEASUREMENTS

James Hundley, M.D., Chairman

DIETARY intake and the expenditure of energy through physical activity, are two components of the nutrition balance sheet of an individual or of a group of people. Methods of measuring dietary intake and energy expenditure are the subject of reports of two subcommittees.

Biochemical measurements are important in the analysis of dietary intake, in the analysis of the relationship of physical activity to cardiovascular diseases, and in diagnostic studies in general. The uses and standardization of biochemical measurements are considered by a third subcommittee.

SUBCOMMITTEE ON METHODOLOGY FOR DIET APPRAISAL

Martha Trulson, Sc.D., F.A.P.H.A., Chairman

Introduction

DIETARY surveys growing out of a suspected relationship between diet and and atherogenesis have increasingly become an integral part of the design of cardiovascular epidemiological studies. The Subcommittee on Methodology for Diet Appraisal was established to examine the existing procedures for collecting and processing food intake information, to study the deficiencies in current procedures, and to make recommendations for future research.

The methodology considered in this report is limited to the study of food consumption of individuals rather than for an average for groups of people. Thus problems of obtaining and processing information at the family or national level are not included. Discussions of computations and laboratory determinations will relate only to caloric values, protein content, and fat content.

After a discussion and summary of the problems encountered in the collection and processing of individual food data, a second portion of the report will present several recommendations aimed at improving and clarifying the status of dietary surveys in relation to epidemiological studies.

Methods in Common Use in Dietary Surveys

There are several different dietary study methods in current use in epi-

demiological surveys. In order to yield meaningful information, they must all include certain minimal facts about the subject, such as age, sex, occupation, height, present weight, weight changes over a period of years, activity, health status (including intestinal parasitic infestation in subjects from certain areas), the usual number and time of daily meals and where the meals were eaten, and current medication or dietary supplements.

The evaluation of dietary intake involves two procedures: (1) the recording of the foods eaten during the period of observation, and (2) the conversion of the intake record into units of food or nutrients.

Collecting Food Information

There are several technics in common use for preparing a food record. The outline below presents an arbitrary classification of these procedures in terms of characteristics which have important methodological implications. These characteristics are the time period covered, the timing of the recording process, and the method used to determine amounts of foods. In these terms, the methods most commonly used or most reasonably considered for epidemiological studies are:

(a) Intake at specific meals recorded concurrently in terms of weights, household measures, or estimates of quantity.
(b) Intake at specific meals reported by recall, in terms of estimate of quantity or frequency of occurrence of food items.
(c) Current usual intake reported either in terms of estimates of quantity of specific foods, or by frequency of occurrence of food items.
(d) Past changes in intake reported in terms of frequency of occurrence of food items.

When there are concurrent recordings of intake at specific meals (method (a) above) the conversion of the intake record into units of specific nutrients may be accomplished by chemical analysis of samples of the foods or by calculation from tables of food values. When the observation involves recall (methods (b), (c), (d), inclusive), nutrient values can be estimated only through the food value tables.

The concurrent dietary data can be recorded by the subject, by the person responsible for the subject's food, or by a trained observer. Although the recall method, utilizing either an interviewer or a self-administered questionnaire, is one of the most convenient methods of obtaining such data, it has its limitations. For example, whereas a diary or record will yield factual data, an interview will yield only the subjective average of an individual's recalled food intake. This is subject to a large human error factor—perhaps the most important variable and certainly the most difficult to estimate.

This error may be minimized by enlisting the subject's fullest cooperation and also by the skill and talents of the interviewer. The interviewer must be well trained in methods of collecting and treating data. He must be able to establish rapport with the subject. He must have knowledge of the cultural and socioeconomic factors operating in the community, and speak the language or have a very competent interpreter. He must develop technics of eliciting dietary information and of assembling this information. If the subjects are to fill out questionnaires by themselves, then the questionnaire must be pretested under conditions comparable to those of the survey area.

The stress or apprehension caused by the survey itself may bring about a change in the subject's dietary practices. He may temporarily alter his intake to conform to his conception of what he should be eating. If the subject is receiving public financial assistance, he may report fewer or different foods than he normally eats because of fear that the stipend will be reduced. In

other situations the subject may eat "better" than he usually does to impress the workers.

Arteriosclerotic heart disease and hypertension develop over a period of years. Ideally the entire past history of nutritional and other environmental factors should be assessed. The value of dietary studies of individuals' actual current intakes for short periods—one day, one week, or one month—is questionable unless it can be established that the short-term studies reflect usual eating patterns of the past.

Review of Literature

Studies of daily food intake have revealed marked variations even in the same individual.[1-3] Yudkin,[4] using the daily records of postgraduate dietetic students at King's College, designed a study to provide data on the adequacy of dietary studies taken for periods of less than seven days. He found that caloric intake of an individual can differ by as much as 68 per cent from week to week; his data showed that the fat intake was largely responsible for this variation. Thompson[5] weighed the daily food intakes of a group of pregnant women and reported that the "profile" for the nutrient content of the individual diet appeared to retain its main characteristics in two widely separated weeks.

Chappell[6] weighed her own food every day for more than a year. She concluded that an observation period longer than one week has little advantage over shorter ones if only an average estimate of nutrients is desired. A more accurate estimate could be obtained from three weekly records of weighings chosen seasonally throughout the year. McHenry,[7] after studying the food intakes of a small group of "normal" persons at intervals throughout a year, reported that the variations were of such magnitude that ". . . if the intakes for this group had been recorded for a single week's period, the results would have varied considerably depending upon which week was used."

Young and co-workers[8] concluded that when daily diaries are used, averages for groups did not appear to vary sufficiently from week to week to warrant more than a seven-day record. In contrast, to adequately study the intake of an individual, it would appear that for some individuals, more than a single week's record would be desirable.

Variations in the dietary intake depend upon many factors, especially food supply, seasonal changes, and socioeconomic factors. Religious and cultural patterns alter intakes of certain foods at specific periods of the year. The degree of internal variability and its relationship to the design of the total study must be considered in selecting the time span over which the dietary information will be collected.

Estimates of nutrient intakes calculated from the food table vary with the method of collection of information on food intake, even when the same individuals and the same food intakes are being studied. Experience in comparing nutrient values resulting from three different methods of collecting data are summarized by Young[9] as follows:

1. The dietary history [defined by Burke as ". . . the average food intake over a considerable period . . ."[10]] was compared with the 24-hour recall, and the seven-day record with 24-hour recall, as methods of estimating the nutrient intake of an individual and of a group. Data for these comparisons were obtained from three different population groups: grade school children (New York), high school and college students (Rhode Island), and pregnant women (Massachusetts).
2. For an individual, in any of the three population groups studied, the 24-hour recall did not give the same estimate of dietary intake as the dietary history.
3. For an individual, in any of the three population groups studied, the 24-hour recall did not give the same estimate of dietary intake as the seven-day record. To describe the intake of individuals, the

two methods could not be used interchangeably.

4. For the mean of a group, the dietary history gave distinctively higher values for grade school children and for pregnant women than did the estimates obtained by a 24-hour recall. The history and 24-hour recall gave results which were in better agreement for the college group studied.
5. For the mean of a group, the seven-day record and the 24-hour recall tended to give approximately the same estimates for the dietary intake for most nutrients. This was true for all three population groups to which the two methods were applied: grade school, high school and college students, and pregnant women. Under certain circumstances the 24-hour recall can be substituted for the seven-day record in estimating group intakes.

Bransby[1] also reported that the values calculated from weighing, household measurements, and questioning of the children were in broad agreement for energy and nutrient content. These did not check closely with chemical analyses of the foods (Tables 1, 2).

Morrison[11] found that the memories of eight scientists for a 24-hour recall of food intake were extremely unsatis-

Table 1—Average Daily Energy and Nutrient Intakes Found by Four Methods of Survey in the National Children's Home, Harpenden (49 Children)

Item	Method of Survey: Weighing Value	Weighing S.D.*	Homely Measures Value	Homely Measures S.D.*	Questioning Value	Questioning S.D.*	Chemical Analysis Value	Chemical Analysis S.D.*
Calories	2,660	507	2,771	423	2,607	487	2,381	218
Protein, gm†	83	18	89	16	81	18	89	16
Fat, gm	96	22	107	21	95	19	81	14
CHO, gm‡	366	69	363	52	357	68	324	39

* These are standard deviations for a single child and were calculated from the actual three-day intakes of nutrients, the resulting values being divided by three to obtain the above figures.

† Protein—N x 6.0, as the diets contain both animal and cereal protein.

‡ The starch values determined by the method adopted were increased by 21 per cent to permit comparison between analytical and calculated results.

Adapted from Bransby, E. R.; Daubney, C. G.; and King, J. Comparison of Results Obtained by Different Methods of Individual Dietary Survey. Table 5. Brit. J. Nutrition 2:101, 1948.

Table 2—Correlation Coefficients Between Energy and Nutrient Values Found by Four Methods of Dietary Survey in the National Children's Home, Harpenden

Methods* Correlated	Calories	Protein	Fat	Carbohydrate
W x H	0.94	0.90	0.93	0.93
W x Q	0.94	0.94	0.91	0.93
W x A	0.87	0.92	0.57	0.81
H x Q	0.91	0.87	0.87	0.91
H x A	0.85	0.82	0.53	0.71
Q x A	0.80	0.88	0.43	0.75

* W = Weighing, Q = Questioning, H = Homely measures, A = Chemical analysis.

Adapted from Bransby, E. R.; Daubney, C. G.; and King, J. Comparison of Results Obtained by Different Methods of Individual Dietary Survey. Table 8. Brit. J. Nutrition 2:103, 1948.

factory on an individual basis. However, the averages for the group were similar to the calculated averages of the weighed food.

There is a paucity of published data on methods of studying long-range eating patterns. Trulson and McCann[12] investigated the patterns of 39 Italian-American male factory workers using a research history method, and repeated the study after a two-year interval. The mean intakes of the group for calories, protein, and fat as estimated from the two surveys did not differ significantly, but there was considerable individual variation. The correlation coefficients between the two surveys for the intake of protein, fat and carbohydrate were approximately 0.5. The error in the method and changes in food supplies, economic status, occupation, etc., could have contributed to these differences. The information collected may be a closer approximation of current eating practices than it is of long-range patterns.

Marr[13] examined the dietary records of middle-aged male British bank officers obtained by the weighing of food for two periods. The second period was selected approximately six months after the first period, in an attempt to measure seasonal variations as well as reliability of reporting. The data from 25 men are reported in Table 3. There appears to be considerable stability in the nutritional habits of these men during this six-month period. For energy value and for the nutrients calculated (protein and fat), correlation coefficients for the two periods ranged from 0.72 to 0.87. The coefficients for fat (land, animal, marine animal, and vegetable) ranged from 0.81 to 0.87 (Table 3).

From the preceding discussion, it is evident that more knowledge is needed regarding the reliability of the results obtained by different methods in common use for collecting dietary information. It is not yet possible to utilize intake results obtained by one method for predicting results expected from another method. Further research is needed on individual food consumption to identify the characteristics of a diet pattern which are constant and not greatly affected by daily and weekly variation.

The problems encountered in the processing of dietary data will be presented and discussed in the next portion of this report.

Table 3—Twenty-five Individual Repeat Weeks Weighed Diet Survey

(Bank officers, males, 40-55 years inclusive)

	1957–1958 Average Daily Consumption		
	First Survey	Second Survey	Correlation Coefficient
Calories (Cal.)	2,769	2,819	0.84
Protein (gm)	82	83	0.72
Carbohydrate (gm)	326	338	0.82
Fat: total (gm)	127	126	0.85
animal (gm)	93	92	0.80
marine (gm)	6	7	0.81
vegetable (gm)	28	27	0.87
Calories from fat (%)	41	40	0.83

Marr, J. W.; Heady, J. A.; and Morris, J. N. Repeat Individual Weighed Diet Surveys. Proc. Nutrition Society 18, 1, xii, 1959.

Table 4—Calculated Intakes of Food Components: Comparison of Analysis of Duplicate Samples of Diets and Calculation of Their Contents

Nutrient	Method	Day 1	2	3	4	5	6	7
Energy, (calories)	Analysis							
	Sample a		1,968	2,297	2,512	2,018	2,051	2,384
	Sample b	1,521	1,941	2,277	2,553	2,075	2,032	2,411
	Difference		27	20	41	57	19	27
	Estimation*	1,516	2,152	2,260	2,674	2,238	2,288	2,339
Protein (gm)	Analysis							
	Sample a	56.5	76.0	64.4	87.0	68.0	74.4	86.2
	Sample b	53.8	69.7	67.6	85.5	72.8	76.0	85.7
	Difference	2.7	6.3	3.2	1.5	4.8	1.6	0.5
	Estimation†	65.6	95.9	75.6	84.5	84.1	83.7	83.6

* Heat of combustion.

† Values derived from standard tables by multiplying total intakes of protein, fat, and carbohydrate by factors 5.65, 9.45, and 4.1, respectively.

Thomas, R. U., et al. Nutritional Status of Children. XIII. Accuracy of Calculated Intakes of Food Components with Respect to Analytical Values. J. Am. Dietet. A. 26, 11:891, 1950.

Processing Dietary Data

There are three methods which the researcher may use to evaluate the dietary data: (a) chemical analysis of representative samples of the food consumed; (b) calculation of individual nutrients, using food tables; and (c) classification of information according to food usage. Each of these methods will be examined briefly.

Laboratory Analysis

Acceptable methods have been standardized for the analysis of foods for a few nutrients. Procedures for pyridoxine determinations remain unsatisfactory. Analysis of foods for total fat continues to present problems while the best methods for analysis for specific fatty acids remain to be selected.

Work on these problems continues currently in the U. S. Department of Agriculture as well as in many other laboratories. A committee appointed by the Interdepartmental Committee on Nutrition for National Defense is working on further standardization of methods suitable for obtaining valid aliquots and for the analysis of food samples.

Table 4 shows differences in the analysis of duplicate samples as reported by Thomas.[14] Difficulties were described in obtaining consistent results from the analysis of duplicate samples from nonhomogeneous dishes such as meat stew. The greatest variations occurred when such foods as fried potatoes or green beans cooked with bacon fat were on the menu.

The best data on nutrient intake for a specific time segment are probably obtained by weighing and analyzing food items or aliquots of the diet as eaten. Expense and practicality may make such detailed observations infeasible. This technic has the further limitation that it can be used only for prospective studies which cover a specific time span and require concurrent observations. As with other methods the possibility exists that weighing and sampling may influence the kinds and amounts of food the subject eats, by focusing his attention on his diet.

The main usefulness of direct analysis of foods in epidemiological studies is for establishing the reliability of results obtained from other methods.

Calculation from Food Tables

Dietary intakes obtained by recall technics and meal recordings are frequently converted to nutrient intake by use of the standard food tables.

There are a number of studies in the literature which compare chemical analysis to calculated reports. Table 5 presents a summary of the differences resulting from treatment of the same dietary data by both laboratory analysis and calculation from food tables.[1,15-42] Caloric and protein values were within 10 per cent in more than half the cases, but only 25 per cent of the fat determinations were within this range. Only 15 per cent of the calculated values for calories and protein varied from laboratory analysis figures by more than 20 per cent, while more than 50 per cent of the fat determinations were outside this range.

Most of these differences can be attributed to the calculation of the protein and fat content of the meat. Tables of food composition prior to 1950 and some of the more recent tables express the values for raw meats on the basis of carcass or wholesale cuts, and have little or no information on trimmed retail cuts, either raw or cooked. It has been customary to use the data for the raw meat in estimating nutritive values. When meat is cooked there is considerable loss of fat into the drippings, resulting in a large reduction in calories and very little loss in protein. Fat adhering to the muscle frequently is trimmed from the meat after it is cooked, thereby reducing the calories further. Therefore, it is to be expected that the values for meat as calculated from the tables will be high for fat, and consequently for calories, but will be within a reasonable range for protein. If meat constitutes a large proportion of the diet, the calculated values for fat and calories for the diet as a whole probably also will be too high.

A recent publication[44] concerning the nutritive value of cooked meat helps to elucidate some of the apparent discrepancies between analysis and calculation of meat fat. Future revision of food tables are planned to provide more

Table 5—Comparison* of Calculations from Food Tables with Chemical Analysis

	Per cent Difference—Calculations vs. Chemical Analysis							
	−30 or More	−20 to −29.9	−10 to −19.9	±9.9	+10 to +19.9	+20 to +29.9	+30 or More	Total
Calories								
No. of cases	0	8	29	218	73	28	22	378
% of cases	0	2.1	7.7	57.7	19.3	7.4	5.8	100.0
Fat								
No. of cases	20	10	36	66	24	35	68	259
% of cases	7.7	3.8	13.9	25.5	9.3	13.5	26.3	100.0
Protein								
No. of cases	13	14	70	170	29	14	8	318
% of cases	4.1	4.4	22.1	53.5	9.1	4.4	2.4	100.0

* Based on 29 studies. Two of the studies are Canadian, four are British, and the remainder are American. There are 23 different studies reporting comparisons of calories, 25 of protein, and 21 of fat. These studies were published from 1937 to 1959. See references 1, 5, and 15 to 44.

Table 6—Calculations of the Same Weighed Diets by Workers in Eight Different States—Based on 21 One-Day Diet Records

Means and Standard Deviations for Calories and Protein

	Mo.	Wis.	Iowa	Ill.	Mich.	Minn.	S. D. (a)	S. D. (b)
Calories								
Mean	1,978	1,820	1,872	1,893	1,875	1,936	1,924	1,904
S.d.*	432	329	387	351	417	390	406	398
Range	1,295	1,026	1,410	1,233	1,711	1,388	1,567	1,616
Protein (gm)								
Mean	65.6	61.9	57.2	70.9	61.9	55.9	62.4	57.2
S.d.*	17.2	15.9	15.4	33.1	15.5	15.3	15.9	16.9
Range	68.9	65.9	68.7	157.8	67.3	61.7	68.1	74.8

* Standard deviation.

Unpublished data furnished by Dr. Wilma Brewer; based on a pilot study conducted by the NC-5 Tech. Committee; compilation of data by Harriet Roberts.

detailed descriptions of cooked meat. Accuracy of calculations still depends, to a large extent, on adequate description of a food item as it is actually eaten.

It is recognized that direct chemical analysis is the best available method for determining the exact amounts of nutrients supplied by a particular food sample at a particular time. However, calculations using the best available tables of food composition, when applied to a detailed food record compiled over a long period of time, may be more representative of usual intake than chemical analysis of samples of foods eaten during a short period.

In this connection reference is made to the background of the figures on nutritive value of foods published by the Department of Agriculture. The values shown in these tables of food composition are not necessarily arithmetical averages of all analyses available for each nutrient in each food. Many factors are taken into consideration in deriving the particular value shown, such as variety, seasonal and geographic differences, production and consumption statistics, shortage and manufacturing and preparation practices. The nutrient values in the table represent average values throughout the year.

The use of food tables for determining nutrient content of mixed dishes requires very special care, since recipes will differ from day to day, from house to house, and from region to region. Unpublished data from a pilot study[16] show wide variations in the calculation of nutrient content by eight different nutritionists using the same weighed diets and food tables (Table 6). The lack of adequate description of food mixtures places an added burden on the calculator's judgment in selecting the appropriate item in the food table.

Calculation of the nutritive value of carefully obtained food records from appropriate food tables has many advantages. The researcher has great latitude in selecting the specific components to be calculated. The only limitation is the data in food tables. With improvements in food tables, the opportunities to search for possible interrelationships between different components of the food intake and other aspects of the subject's condition will be greatly extended.

Food Usage

The third method of processing the dietary material is according to food usage. Classification according to the frequency of use, amount, type of preparation, periodic intervals of feasting or fasting, patterns of alcohol consumption, and use of condiments may help describe the subject's nutritional environment. A regional publication of the U. S. Department of Agriculture[46] describes homemakers' meals (Table 7). Caloric and protein intake for the Birmingham and Minneapolis women were in close agreement. However, when the diets were classified according to food groups, considerable differences were observed.

No attempt has been made here to review the literature but results from this and similar reports suggest that further study and experimentation with the raw data, in this case intake in terms of food items, may suggest important relationships between food intake and cardiovascular disease.

Discussion

A major defect in the collection and processing of dietary data lies in our inability to make precise or even approximate statements concerning the reliability of the various procedures in current usage. Until such information is available, it is difficult to evaluate the usefulness of dietary appraisal in epidemiological studies.

Mechanical inaccuracies can be decreased through greater use of automatic devices for the processing of data, while variations due to subjective judgments will be reduced to measurable proportions only through standardization of each procedure.

For every dietary study, consideration should be given to establishing the degree of reliability for each step in the

Table 7—One Day Food Intake of Homemakers

Average nutrient content:	Birmingham (261 Subjects)	Minneapolis (245 Subjects)
Calories	1,820	1,720
Protein (gm)	57	61

Food intake according to food groups.
Per cent calories contributed by 11 food groups:

	Birmingham (261 Subjects)	Minneapolis (245 Subjects)
	Per cent	Per cent
Milk, cream, ice cream, and cheese	9.6	14.3
Fats, oils	23.3	10.2
Eggs	3.2	2.8
Meat, poultry, and fish	16.9	21.4
Dry beans, peas, and nuts	3.4	1.2
Potatoes and sweet potatoes	4.1	4.2
Citrus fruit and tomato	1.6	2.8
Leafy, green and yellow vegetables	1.5	1.6
Other vegetables and fruits	3.4	6.4
Sugars and other sweets	9.2	6.1
Grain products	23.8	29.0

Adapted from Clark, F., and Fincher, L. J. Nutritive Content of Homemaker's Meals, Four Cities, Winter, 1948. USDA Agricultural Information Bull. No. 112 (Mar.), 1954, pp. 3 and 30.

collection and processing of dietary information. Such testing of the reproducibility of results should begin with a demonstration of the dependability of the instrument and procedures selected for obtaining and for processing the information. Equally important will be the reliability of the subject as an informant. He should be able to report repeatedly the same factual information. The interviewer must have the ability to interpret diet information objectively. For each procedure which depends upon a subjective interpretation, results from two or more workers should be compared. Through repeated interviews with the same subject, and through the use of built-in cross-checks in a questionnaire, procedures can be pretested for a selected sample prior to the survey of the total population to be studied. Attention to the areas for which reliability is poor or for which reliability appears difficult to check will more clearly point out the deficiencies in presently employed methods.

In addition to the reliability, that is, the error variation in methods of collecting and processing dietary data, the validity of a method is an important criterion of its usefulness. The validity of the method will be judged by the extent to which the data it yields are a true measure of what the investigator wishes to describe. In other words, do the data obtained answer the question that is asked or satisfy the purpose of the investigator? The primary problem is to evaluate how accurately any method of collecting information measures dietary intake, keeping in mind that reliable data for a specific period, such as a week or two, may not be a valid measure of the characteristic diet of an individual.

Summary

The principles of dietary studies currently in use in epidemiological investigations of cardiovascular disease are described in the main body of the report.

There is need for dietary data on individuals which can be related to other information about them. In planning dietary studies certain decisions must be made.

1. What are the objectives for the dietary study?
2. What hypothesis is under consideration?
3. What shall be the time span involved in the dietary study?
   (a) Intake for a specific time
   (b) Usual characteristic intake for some defined period
   (c) Combinations of these
4. What methods shall be used for collecting data?
   (a) Record
   (b) Recall
   (c) Composite of duplicate meals
5. How will amounts be reported?
   (a) Weighing
   (b) Measuring
   (c) Estimating
6. Who shall be the informant?
   (a) Subject himself
   (b) Person responsible for the subject's food
   (c) Both (a) and (b)
   (d) Observer
7. Who will record the information or sample and collect the food?
   (a) The informant
   (b) A trained interviewer
   (c) (1) A nutritionist or other professional person in food or nutrition or closely related field
   (2) Other persons knowledgeable about food
8. How certain is the investigator that his method is securing the information desired?
   (a) The schedule must be pretested unless it has been tested under similar conditions.
   (b) Interviewers should undergo a thorough training period which includes actual collection and treatment of data in trial situations and information on the cultural and socioeconomic factors operating in the community.
9. What additional information concerning the subject is needed?
   (a) Certain minimal basic facts about the subject must be known; age, sex, physical activity and data on physical measurements, and present and

past health status that are to be studied in relation to the dietary data. Some social and economic data may also be useful.

10. How can the data be processed?
    (a) Chemical analysis of food composites or individual foods
    (b) Computation of energy value and nutrients from tables of food composition
    (c) Classification according to food usage or patterns
11. What information can be obtained from the dietary intake?
    (a) The investigator may search for possible interrelationships between different components of the food intake and between the food intake and nutritional health or other aspects of the subject's condition.
12. What are the gaps or lacks in methodology?
    (a) Lacks or limitations have been discussed in the main body of the paper, and the following recommendations to help improve methodology for diet appraisal have been made by the committee.

Recommendations

The members of the committee recognize that ways must be developed to minimize current problems noted in the present methodology of securing information on food consumption of individuals for use in epidemiological studies of cardiovascular disease. They make the following recommendations.

A. *Assembling of Published and Unpublished Work Relating to Methodology of Diet Appraisal*

The committee recommends that a collection, compilation, and critical evaluation be made of published and unpublished work relating to methodology for diet appraisal, particularly material on validation and reliability of methods currently being used. It is recommended that such an evaluation be published and be made available to workers in the field of epidemiological studies of cardiovascular disease.

B. *Preservation of the Original Dietary Data*

The committee suggests that a means of preservation of dietary data be explored. Government agencies can use the facilities of the National Archives. For others, arrangements through appropriate journals with a repository, such as the Library of Congress, will allow for storage and later use. With such a system, well collected dietary material from numerous earlier studies, reported only in terms of carbohydrate, protein, and calories, for example, could now be processed for other nutrients.

C. *Continued Study and Development of Methods of Chemical Analysis, Food Composition Tables, and Classification and Patterns of Food Usage*

(1) Chemical Analysis—The committee recommends continued research on the chemical analysis of food and the standardization of methods. Analysis for fat, technics of collecting and compositing foods, methods of analysis of such composites, as well as better analytical methods for nutrients such as fatty acids and pyridoxine may be cited as areas for investigation.

(2) Food Tables—The committee recommends the expansion of the tables of food composition currently available. Activities are under way to improve and extend several of these. However, more information is needed concerning composition of recipe dishes or mixed dishes, regional dishes, and commercially prepared or partly prepared ready-to-eat foods or food mixes.

One possibility for covering regional variations in nutrient composition of locally grown and locally consumed foods would be to have the U. S. Department of Agriculture collect, compile, and publish such information when available.

(3) Classification of Foods—It may

be as important to investigate the intake of certain foods, types of food, or groups of food as it is to estimate the consumption of nutrients they supply. The committee recommends that additional study be devoted to this area, particularly to accommodate the testing of current hypotheses in epidemiological studies of cardiovascular disease.

D. *Processing of Dietary Data*

To standardize and expedite the processing of dietary data, the use of machine computation should be further explored.

The committee recommends that more systematic effort be devoted to utilizing modern machine devices to calculate dietary intake information into nutrients, food groups, meal patterns, etc. This has already been done for a few studies, but there is no standardized procedure. The saving of time and money as well as the increase in accuracy make this most important.

E. *Research in Methodology*

(1) Short Method for Obtaining Dietary Information

The committee recognizes that there is need for new approaches to methods for obtaining dietary data that can be used in epidemiological studies. Since the objective of epidemiological studies is to search for evidence of possible association between a dependent variable (such as ischemic heart disease) and an independent variable, such a study usually is concerned with a relatively large number of persons who are to be classified into subgroups which will differentiate the persons according to the independent variable. When food intake is the independent variable to be examined, there are major difficulties to be overcome because, unlike such variables as age, hours of sleep, or even number of cigarettes smoked per day, food intake is a multifactor variable which can be classified in many different ways. In any study in which diet or level of consumption of specific commodities or nutrients is to be one of the independent variables, one or more methods of classification must be decided upon and then the data collected in such a way that this classification will be practicable.

If an hypothesis about the relation of a specific nutrient, food, or group of foods to a disease is to be tested, this will determine the axis on which persons will be classified. In many recent studies of ischemic heart disease, association of the disease with amount and types of fat and with the percentages of total calories obtained from such sources have been of principal interest. The results of such studies in the United States have not proved definite associations. Consequently, there is a desire to take a new look at the total problem of food intake, dietary patterns, eating habits, etc., and to correlate this with calorie balance. If this is carried out with no hypothesis to guide the collection of data, what steps can be taken to develop procedures for searching for evidence on which to base some hypothesis for more intensive and controlled investigation?

Essentially, the problem is to find and describe the major differences among individuals with respect to foods eaten, and to develop practical methods for obtaining information needed for classifying people according to selected dietary characteristics. If groups can be clearly differentiated by use or nonuse, high or low use of any food item or items, or other dietary characteristics, then such characteristics can be tested for association with the disease.

It is proposed, therefore, that a short, simple schedule for collecting information about types of foods used and meal patterns be prepared and used for questioning persons in several samples of selected populations. The populations studied should be from communities

known to differ with respect to mortality or prevalence rates for ischemic heart disease. These also might be groups with different rates within a community. The objective would be to compare either mortality or prevalence rates for persons in various diet classifications.

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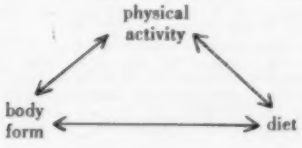
SUBCOMMITTEE ON METHODS FOR ACQUIRING INFORMATION ON PHYSICAL ACTIVITY AND BODY FORM

Harwood S. Belding, Ph.D., Chairman

1. The Task

SUFFICIENT suggestive evidence has been collected of relationship between level of physical activity and development of cardiovascular disease to encourage a rash of hypotheses regarding the mechanisms involved. Meanwhile, further epidemiological studies are required better to define the relationship. Such studies will continue to be complicated by interactions of physical activity with body form (constitution) and with diet. It is obvious that any one of these factors may influence the other two. The fact that the subject of dietary measurements is handled by another subcommittee should not be taken as indication that relationships of any one of these factors can be understood without attention to the other two.



The task of this subcommittee is to consider means by which the physical activity and body form of population groups or of individuals within such groups may be assessed. The consideration of hypotheses and the evaluation of evidence now available is beyond the scope of our assignment. We deal here only with methods of assessment of physical activity and body form.

Our approach to this problem was first to decide what it is that we should know about physical activity of a population under study, then to indicate and discuss means for acquiring the information. This approach was repeated in dealing with body form.

2. Physical Activity

We are agreed that whether the purpose be to describe two homogeneous population groups having different activity habits, or to describe individuals in a population under study, it is necessary to know (a) what the physical activities have been and the environ-

mental conditions under which they have been conducted (i.e., what have been the stresses), and (b) what physiological demands the activities have made (i.e., what have been the strains).

A. *Description of Physical Activities (The Stresses)*

(1) Average Daily Energy Expenditure

This is essential information for even the most primitive classification into activity groups, namely, relatively active and relatively sedentary. It will also tie most closely to studies of effects of nutritional factors. Such information based on activity level in the immediate past of subjects will probably be inadequate for epidemiologic purposes. Ideally, information will be sought over the lifetime, and at the least it will be needed for the adult years.

Exactness of estimate of average daily energy expenditure cannot be expected from technics applicable to epidemiological studies of long-term physiological changes. It seems likely that the general level of physical activity can only be described in terms of about three grades: light, moderate, and heavy.* For uniformity in usage of these terms, we suggest that light be used to describe daily activities involving up to 2,400 calories of energy expenditure per day for a man of average† size, moderate be used for 2,400-3,200 calories, and heavy be used for expenditures in excess of 3,200 calories. Since the energy requirement for rest is about 1,800 calories/day, light represents up to 600 calories of work; moderate, up to 1,200, and heavy, above 1,200. Assessment may be by interview, or more accurately by study of the characteristics of the job performed and supplementary information from available sources on activities during off-job hours. Of use in these connections are summaries that have been published on the energy cost of various tasks (see Passmore, R., and Durnin, J. V. G. A. Physiol. Rev. 35: 801-840 (Oct.), 1955). However, some common tasks have not been studied. Furthermore, published values may be

* It is believed that classifying workers with reasonable accuracy into three categories of physical activity requires visits to the job site by experienced observers and, under ideal circumstances, measurement of the energy requirement of any tasks with which the observer is unfamiliar. It should be recognized that when such classifications rest primarily on occupation, the assumption is made that leisure time activities are not so distributed that the energy expenditure of the sedentary group is increased enough to compromise the difference in energy levels between the sedentary and moderately active group. It may be noted that this was actually the case in the study of miners and clerks at Fife, Scotland, in 1952, where it was found that in 19 coal miners the energy expenditure in activities not at work was 1,420 calories per man per day, while among 10 clerks it was 1,410 calories. Common sense classifications will place clerks in the light activity group and miners in the group which requires heavy physical activity, yet the total energy expenditure of miners was 3,660 calories, and that of clerks 2,800. The difference in total energy expenditure of 860 calories is not really large and means that if one is to define a group employed in moderate physical activity one is attempting to distinguish differences of the order of only 300 or 400 calories. To do this with precision obviously requires a good deal more than just casual questioning.

When the observer does not have first-hand knowledge of actual job conditions, it is believed that a satisfactory classification of the activity level can be made by using two classes designated sedentary and physically active with a third group designated as moderately active and/or uncertain. This kind of classification was used by Morris, J. N.; Heady, J. A.; Raffle, P. A. B.; Roberts C. G.; and Parks, J. W. Lancet 265:1053-1057 (Nov. 21), 1953 in classifying death certificate data in activity groups based on last known occupation, and by workers in the Minnesota Laboratory of Physiological Hygiene studying railroad employees.

† A man of average size is one who weighs 70 kilograms, is about 178 cm tall and has a surface area of 1.85 m^2. For most purposes, body weight is an adequate measure of resting energy expenditure. Its accuracy as a measure of average daily energy expenditure varies somewhat with the amount and kind of work done. The arbitrary caloric levels for grades of work may be adjusted downward or upward in accordance with percentage deviation of an individual's weight from 70 kilograms; the degree of accuracy required and the range of work energy being studied may indicate the use of more nearly precise formulae.

misleading because the energy expenditures for a particular job may not be equivalent from country to country due to differences in methods. For example, E. H. Christensen's values (Symposium on Fatigue. Floyd, W. F., and Welford, A. T. (Ed.). London: H. K. Lewis, 1953, pp. 93-108) for various jobs in the Swedish steel industry do not correspond to those of Ford, A. B.; Hellerstein, H. K.; and Turrell, D. J. (Circulation 20:537-548 (Oct.), 1959) for these jobs in Cleveland.

For relatively homogeneous population groups, with established and consistent patterns of activity (e.g., prison populations, or fishermen in a fleet) it would be worth while to make sample measurements of oxygen utilization and to maintain an accurate log of time spent in various activities as a means of improving the estimate of total energy utilization. A little arithmetic will show that the largest errors in estimating work calories are in the estimation of time spent at any particular task. Probably the most accurate index of total energy expenditure (for such populations) may be acquired by careful assessment of the caloric value of the diet.

Meticulous application of existing methods for estimating over-all daily energy expenditure cannot be expected to have accuracy better than $\pm$ 300 calories. This degree of accuracy will not be required for most epidemiologic studies.

(2) Variety and Pattern of Activity

This information may be as important as that on average level of activity. Relatively brief, but frequent, bursts of activity may be significant for establishing or maintaining muscular power and cardiovascular capacity among those classified as less active on the basis of average daily energy expenditure. Furthermore, man being rhythmic as regards activity levels, the very rhythmic pattern between work and rest may affect his long-term well-being.

Desirable knowledge includes customary peaks of energy expenditure and their frequency. The types of muscular activity also may be pertinent; e.g., whether static or dynamic (because static heavy effort affects cardiac filling —the Valsalva effect); whether heavy or light; whether involving few or many muscle groups (see Lehmann, G. Praktische Arbeitsphysiologie, Stuttgart: Georg Thieme Verlag, 1953). Information on activity during and outside of gainful employment, including sexual activity and sleep habits, is needed for a reasonably complete picture.

Methods involved in assessment of activity peaks and pattern of activity are generally similar to those utilized for determining the total daily energy expenditure. The emphasis here is on determination of the history of heavy demands on the circulation and on distinguishing between situations involving free-filling and restricted-filling of the heart. The likelihood of bias in the subject's evaluation of his maximum efforts is not known. Error of estimate is encouraged by the fact that most activities (whether they be brick laying, climbing hills, or playing tennis) may be accomplished at widely varying speeds.

Data on current on and off job activities of subjects can often be quite accurate. However, such will not be regarded as sufficient for purposes of studies of onset of chronic disease. Collection of data on the lifetime of prior activity, by interview of subject, relatives, and associates is necessary, despite the fact that such data will be less accurate.

In taking a detailed activity history one must inquire carefully regarding the principal energy consuming tasks on the job and the time spent doing each one. (See Appendix 2 for check list of items to be covered in ques-

tionnaires regarding physical activity.) Attention should also be paid to rest pauses and activities requiring little or no energy, the mode of transportation to and from work and the activities during recreational periods. Questions should be directed at the amount of time spent walking both on the job and off the job. Care should be taken to see that the subject does not confuse standing with walking. In all cases an attempt should be made to obtain some estimate of the time spent in each task.

Each subject should be asked to describe the most strenuous task which he performs and the frequency with which he performs it. It is believed that this question should be left to the end of the interview since it is a leading question which sometimes leads to overstatement and boasting. Under ideal circumstances, then, an interview would yield an estimate of the total energy expenditure in three grades plus an indication of the intensity and frequency of the significant peak loads.

Again under good circumstances special questioning into leisure time activities should be carried out. Experience has shown that the majority of energy consuming leisure time activities are of the type which demand a low rate of energy expenditure and center around gardening, home repair and hobbies requiring tools, or sports such as golf (except on hilly courses) which do not require peaks of high energy expenditure. However, there is a group of men who spend time in gyms participating in bona fide high peak energy expenditure tasks, such as squash and handball, requiring the utilization of a good deal of anaerobic energy. Anaerobic exercise of this kind is quantitatively and qualitatively different from the usual physical activity of the average wage earner with or without hobbies and in those situations where it is feasible, men of this type should be placed in a separate category. It is believed that these men are easily identified if the observer will take time to make a distinction between men who go to the gym for companionship and only a token amount of exercise and those men who spend three to four hours a week in participation in high energy level contests.

It should be emphasized that there has been practically no systematic effort to validate an activity history. When one actually examines the available data it is found that very little is actually known regarding physical activity patterns and energy expenditures of the American wage earner living in large urban centers.

Since walking is an activity which requires more energy expenditure than that found for many production workers in industry (Hellerstein, H. K., and Ford, A. B. J.A.M.A. 164:225-231 (May 18), 1957; Ford and Hellerstein, Circulation 18:823-832 (Nov.), 1958), the time spent in walking by salesmen and office workers in large banks and industrial concerns is of real consequence. Very little is known concerning walking patterns of such men, whose work would be classed superficially as light, but which may actually fall into a higher category.

The time distribution of activities is important, but it may be just as important to identify the man who always walks rapidly and prefers walking upstairs to riding an elevator. It should be noted that increasing the speed of walking on the level from 2.0 to 4.0 miles per hour increases the calories expended per minute (but not per mile) for a man who weighs 160 pounds from 3.2 to 5.8. In this context it may be noted that there is no information on the distribution of walking speeds among American men. Walking speed might be used as an index of "drive," in studies where this was a parameter of interest.

Pulse rate* and pulmonary ventilation† are correlated with the energy demands of activity. If a high degree of correlation were established for such physiologic responses, data obtained from 24-hour use of monitoring apparatus could be converted to values for peak and daily energy expenditure.

See Appendix 1 for sources of information on methods for objective measurement of energy utilization.

(3) Environmental Factors

Certain components of the environment may enlarge or diminish the stress of activity. Of most obvious importance is the thermal environment. Work in heat is accomplished at greater cardiac cost (e.g., Robinson, S.; Turrell, E. S.; and Gerking, S. D. Am. J. Physiol. 143:21-31 (Jan.), 1945; Belding, H. S., and Hatch, T. F. Heating, Piping and Air Conditioning. ASHAE Journal, Section 127, pp. 129-136 (Aug.), 1955), and with distribution of a substantial fraction of output through cutaneous vessels; habituation to cold involves different utilization of the cardiovascular system. The general thermal environment should be a matter of record, particularly if comparison is to be made between population groups from geographical areas with widely different climatic conditions. For subjects exposed to process heat in performance of their jobs, the fact of exposure should be recorded.

Objective data on physiologic responses to work (vide infra) should be collected under standardized thermal conditions; if this is not feasible, the environmental conditions should be described.

Other environmental factors of possible consequence and interest include barometric pressure, noise, and vibration.

The sociologic and cultural environments in which life activities are conducted may be of importance in potentiating or canceling effects of physical activity per se. It is hardly within our sphere of competence or responsibility to point out methods of describing these environments in terms of the stresses ("tensions" or "drives") which they present. Nevertheless, we recognize that some jobs involve threat of catastrophic consequence for mistakes in judgment or performance (e.g., piloting a plane or other public transportation, high level decision making) and that individual workers on such jobs may or may not be affected by these stresses, depending on temperament, but the presence of such stress should be a matter of record in epidemiologic studies. In other instances personal "drive" may result from competition. This may be reflected in average daily energy expenditure (pace of physical activity), but if the "drive" is nervous rather than physical in its expression, it may not be measurable by available methods.

B. *Description of Physiologic Strains of Activity*

(1) Customary Activity

Descriptions of the work pattern and environmental conditions of a study population are no more important than knowledge of the physiologic responses of the population to the stress of life activities. Significant leads toward identifying causes of cardiovascular (CV) disease may be found in compari-

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* Christensen (loc. cit.) classifies the "heaviness" of work as follows:

	Cal/hr	Pulse/min
unduly heavy	750	above 175
very heavy	600	150-175
heavy	450	125-150
moderately heavy	300	100-125
light	150	75-100

These values apply for the work itself. They do not include rest pauses.

† Developers of the IMP (see Appendix 1) believe that respiratory minute volume is closely proportional to energy expenditure, over a wide range of activities. The IMP yields direct information on respiratory minute volume.

sons between populations having apparently similar activity levels, but exhibiting different degrees or types of physiologic responses. Heart rate, blood pressures, blood volume and composition, cardiac output, and respiratory responses to customary activities represent only a few of the parameters potentially important in relating work to CV disease.

The work physiologist relies on work and recovery pulse rates as important indicators of over-all CV strain produced by activity. A lower pulse rate is held to be consistent with less CV strain and greater cardiovascular fitness. Cardiologists rightly point out types of CV abnormality in which such interpretations may be erroneous. Actually, we cannot recommend sole reliance on pulse rate or any other single parameter as a measure of CV strain.

Burgher has again pointed out (Burgher, G. C. E., and Marten, G. A. Proc. XII Internat. Cong. Occup. Health 3:113-118, 1957) the desirability of using pulse pressure during activity in conjunction with pulse rate, and has demonstrated how such values may be utilized to derive an index of heart work.

(2) Standard Activity

In comparing populations having different activity levels it will often be useful to know the responses to a standardized level and kind of activity. Presumably such activity would be selected to lie within the competence of most members of the population under study. Walking on the level or up a moderate grade is probably the best activity for these purposes. The most meaningful physiologic values will be obtained after subjects have been exercising for some time and have acquired such a "steady state." Recovery pulses, blood pressures, etc., will also have some meaning (cf. Johnson, R. E.; Brouha, L.; and Consolazio, F. Rev. Canad. Biol. 1:491-503 (June), 1942). The Master's stepping exercise might be modified for this purpose, but probably will not be suitable at standard pace because it represents heavy work (classification of Christensen, loc. cit., based on data of Ford, A. B., and Hellerstein, H. K., J.A.M.A. 164:1868-1874 (Aug. 24), 1957) in which a "steady state" will ordinarily not be achieved by most subjects.

(3) Maximum Activity

Knowledge of the maximum capacities and limitations of the CV system would be useful in comparing populations, and especially in studies of the time course of change in capacity among groups with different activity patterns. Such information could also provide an objective check against acceptance of subjects' exaggerated claims of physical prowess.

The problem of estimating maximum capacity for work for middle aged and older subjects is difficult because we will not accept risk of injury, and to require maximum effort may or may not involve such risk. The need is for a means of determining capacity without requiring maximum effort. While there is no established reliable means for accomplishing this, leads have been provided. Astrand (Thesis from Gymnastika Centralinstitute, Stockholm, 1952), in his study of working capacity of normal subjects in relation to age, showed that heart rate at submaximal work levels can be used to predict maximal levels of work output with fair accuracy. His subsequent research has been designed to evaluate this concept for less fit and older populations (results not yet available).

German (Muller, E. A., Freiburger Symposium. Heidelberg: Springer-Verlag, 1958) and Dutch workers have been predicting maximum level of sustained work by measuring pulse response to increments of work on the

bicycle ergometer.* The exercise may be terminated at a level predetermined as "safe" (e.g., 125 or 150 beats per minute), or on the basis of ECG changes. The curve of heart rate against work is then extrapolated to 180 beats per minute (or a lower value for an older subject; inferred from Robinson, S., Arbeitsphysiologie 10:251, 1938). The validity of such predictions depends on the degree of extrapolation that is required. We would endorse support of studies further to develop and define the accuracy and sensitivity of predictions of work capacity based on heart rate and/or respiratory ventilation.

The extra circulatory burden of exposure to warm environmental conditions during a performance test may be considerable (vide supra). For example, our computations using Robinson's data (loc. cit., 1945) indicate extra demands of 1.5 liters per minute or more for cutaneous circulation when men are resting in heat and up to 3.0 liters or more when they are working. It is clear that thermal stress must be minimized or controlled in application of tests such as those described above. Research may be warranted to determine the usefulness of responses to thermal stress (in lieu of exercise) as a measure of cardiovascular status and capacity.

C. *General Observations*

(1) Prospective vs. Retrospective Studies

The working group spent some time in weighing the opportunities for gathering information on physical activity in relation to development of CV disease, (1) when the population is chosen for a longitudinal study in advance of major CV incident, and (2) when the population is chosen afterward. The cost of the two types of approach is not our direct concern, but since the prospective type of study costs much more, the results of our deliberation on this subject may be of interest.

It seems to us that the possibility of collecting accurate data regarding level and type of physical activity is much greater while the subject is "well." The present average and peak levels of activity and the physiological responses to work are directly observable. After sickness is recognized these advantages of direct observation are lost, and the prospect of obtaining an unbiased accounting of prior total physical activity from the subject or observers is lessened because of the vagaries of memory. To the extent that there is a long-term employment record on members of the study population this disadvantage will, of course, be less important.

(2) Two Approaches in Study of Physical Activity

The information needed and the methods in attempting to find relationship between physical activity and CV disease will vary with the type of approach that is intended. We recognize two major approaches: study of two or more population groups assumed to differ in physical activity; and study of a single population, supposedly with diverse activity levels and attempting to classify its individuals as to physical activity.

(3) Study of Populations Selected by Occupation

When the study is of the first type, the energy demands and type of work should be ascertained by direct observation by a work physiologist, using technics for sampling oxygen consumption of special activities and time study as required, with view to ascertaining average total energy requirement and peak energy requirement and distribution of deviations from average. Such

* See also Correlation of Static and Physical Endurance, USAF, IA. A Test of Physical Performance Based on the Cardiovascular and Respiratory Response to Gradually Increased Work. Bruno Balke, USAF School of Aviation Medicine, Randolph Field, Tex. Project No. 21-32-004, Rep. No. 1, 1952.

data are necessary to show how different the two populations really are. Sufficient data on employment history must be examined to assure that employment has been (or in prospective studies will continue to be) stable.

A representative sample of each population should be chosen (minimum requirement) for administration of an interview designed to establish average, and deviations from average, total daily activity, as well as maximum activity levels over the adult years. The same sample should be subjected to body measurements, so that homogeneity or differences in build may be established for groups that are to be compared (vide infra).

It would be desirable to have total activity and body build data on the total population, as a basis for sorting out subjects who are atypical. It is also desirable to have information on current cardiovascular status of the sample or the full population; whether available exercise tests can define cardiovascular status sufficiently for purposes of epidemiologic studies is not known, but we consider the likelihood promising.

(4) Study of Nonhomogeneous Populations

When the study is of the second type, of a population which is apparently nonhomogeneous as regards activity level and type, it becomes necessary to classify each individual on the basis of physical activity. This should be accomplished by interview of all members of the group. In addition it would be desirable to test the validity of interview data by administration of the same interview to associates at work and to friends, as well as by examination of employment records.

Categories of work that may be differentiated are light, moderate, and heavy as regards average physical activity. Peak levels may be classified as high, moderate, or low. For those having moderate to high level peak activities it may be useful to differentiate primary requirements of speed (intermittent muscular contraction), endurance (for extended periods), and strength (lifting, pushing, carrying, and so forth).

"Minimum acceptable" measurements of body form will be needed on all members of the population.

Comments made above regarding desirability of measures of CV function and capacity through exercise tests are equally applicable in this type of epidemiologic study.

(5) Retrospective Studies

Some parts of these observations have been applicable only to prospective studies. It is recognized that direct measurements will have reduced usefulness in studies of factors related to onset of CV disease using populations in which heart disease is already present. When the interest is in progress of CV disease after its first manifestation some of the direct measures will still be applicable.

3. Body Form*

A. *Information to Be Sought*

Body form may be related to the occurrence of cardiovascular disease (a) directly, through some unsuspected or uncontrollable mechanism (genetic linkage), or (b) indirectly, via some other factor(s) now thought to be associated with cardiovascular disease, such as occupation, biochemical status, physical activity, or diet.

Even if the primary association of body form with cardiovascular disease is stronger than its association with other atherogenic or "hypertensogenic" factors, the causality is obviously not direct; that is, body form does not in

* The Working Group expresses its appreciation to H. T. E. Hertzberg; W. W. Howells; and W. M. Krogman for suggestions which appear in this section.

itself "cause" disease. As in all epidemiologic studies, the underlying mechanism will still have to be sought in the laboratory.

(1) Relation to Cardiovascular Disease

Other committees beside this one—specifically, those on pathology and genetics—have cited the evidence for an association between body form and coronary heart disease. Such evidence comes from two sets of investigators using the somatotype technic for describing body build. Gertler, M. M., and White, P. D. (Coronary Heart Disease in Young Adults. Harvard University Press, 1954), working with clinical material, characterized young coronary patients as predominantly "mesomorphic" (bony-muscular) and secondarily "endomorphic" (round, fat); Spain, D. M.; Bradess, V. A.; and Huss, G. (Ann. Int. Med. 38:254-277 (Feb.), 1953), on autopsy material, called such patients predominantly mesomorphic. In a later study, Spain, D. M.; Bradess, V. A.; and Greenblatt, I. J. (Am. J. M. Sc. 229:294-301 (Mar.), 1955), reported that among endomorphs and mesomorphs, but not "ectomorphs" (linear, asthenic), coronary sclerosis paralleled serum beta-lipoprotein levels. The consistent results of these two sets of investigators require confirmation, with additional measures of body form and with better controls. For example, 27 of Gertler and White's 100 coronary patients but very few of their unmatched controls were Jewish.

Many reports, too numerous to cite, relate hypertension to stocky rather than lean builds. Hippocrates was merely the first to note the "apoplectic habitus." Malignant hypertension has, however, been said (Perera, G. A., and Damon, A. Arch. Int. Med. 100:263-265 (Aug.), 1957) to occur in women significantly leaner, by the height/cube root of weight index, than women of the same age, from the same clinic, with either benign hypertension or no known disease.

The stocky, muscular physique reportedly prone to both types of cardiovascular disease, coronary heart disease and hypertension, thus contrasts sharply with the lean physique found more susceptible to tuberculosis, in recent large-scale prospective studies both in England and the United States. (Berry, W. T. C., and Nash, F. A. Tubercle 36:164-174 (June), 1955; Palmer, A. E.; Jablon, S.; and Edwards, P. Q. Am. Rev. Tuberc. Pulm. Dis. 76:517-539 (Oct.), 1957). So once more Hippocrates may have been right in contrasting the phthisic and apoplectic habitus.

(2) Relation to Biochemical Factors

Since Miassnikow (1851), many investigators have reported that cholesterol is higher in those of stocky than lean body builds. This has recently been suggested as an association with body fat rather than muscle. (Keys, A; Anderson, J. T.; Fidanza, F.; Keys, M. H.; and Swahn, B. Clin. Chem. 1:34-52 (Feb.), 1955); (Miller, D. C.; Trulson, M. F.; McCann, M. B.; White, P. D.; and Stare, F. J. Diet, Blood Lipids, and Health of Italian Men in Boston. Ann. Int. Med. 49:1178-1200 (Nov.), 1958); and (Tanner, J. M. J. Physiol. 115:371-390 (Dec.), 1951). To distinguish fat from muscle, Keys and Miller used skinfolds; Tanner used both skinfolds and somatotype.

The consistent relationship noted between body fat and serum cholesterol is low, with a coefficient of correlation at best 0.40, though statistically significant. However, muscularity of build, said to characterize persons particularly susceptible to coronary heart disease, has with equal consistency shown no relation whatever to serum cholesterol levels. This is puzzling in view of the well documented elevation of serum

cholesterol among patients with coronary heart disease. Perhaps Dr. Spain's hypothesis of a lower threshold for atherosclerosis among muscular persons affords an explanation. More research is obviously needed on this point.

(3) Relation to Occupation and Physical Activity

Since Morris' work (Morris, J. N.; Heady, J. A.; Raffle, P. A. B.; Roberts, C. G.; and Parks, J. W. Lancet 2:1053-1057 (Nov. 21), 1953), on British bus drivers and conductors and on postmen and telegraphers, occupational differences in coronary heart disease have been attributed to energy expenditure. However, there is a real possibility that self- or job-selection results in a concentration of certain "types," physical or constitutional, in certain occupations. Morris himself recognized this possibility, finding that bus drivers had larger waists than conductors on entering service with the bus company (Morris, J. N.; Heady, J. A.; and Raffle, P. A. B. Lancet 2:569-570 (Sept. 15), 1956). Previous independent work on American bus and truck drivers showed that they were more mesomorphic and stockier than the general population (Damon, A., and McFarland, R. A. Am. J. Phys. Anthropol. 13:711-742 (Dec.), 1955). The same authors indicate that consistent physical differences have been reported among occupations, and adduce evidence that these are not caused by the occupation (Damon, A., and McFarland, R. A. J.A.M.A. 153:622-625 (Oct. 17), 1953).

In a recent letter, Dr. Morris informs us that further analysis of morbidity and mortality data among bus drivers shows plenty of heart disease among both fat and thin. However, fat drivers have more heart disease than fat conductors, and thin drivers have more than thin conductors. Here again is an area which needs further study.

B. *Methods for Obtaining Information*

Descriptions of body form for studying correlations with cardiovascular disease are obtained from height, weight, and other anthropometric dimensions, skinfold thickness, somatotypes, strength tests, and physicochemical analyses of body composition. The last four technics attempt to supplement the useful height-weight relationship by apportioning total weight or bulk among various tissues and compartments, particularly distinguishing muscular-bony from fatty components.

(1) Height and Weight

Height and weight are minimum essentials and should be taken as nearly nude as possible. The practice of permitting "light" clothing and footgear has vitiated several large and expensive studies. If some clothing must be worn —and socks, shorts, and brassiere may have to be permitted—several representative clothing samples should be weighed to give an accurate subtraction constant.

These basic dimensions should be taken with the care expended on the ECG and cholesterol determination. Sloppy technic by untrained or unsupervised technicians is all too common.

Height should not be taken with the bar attached to some medical balance scales, but preferably against a flat wall, without a molding at the base, with the subject instructed to stretch to his maximum height and to take a deep breath. Printed engineering strips ruled in inches and tenths, or in centimeters, are satisfactory for pasting on the wall. A cigar box or other right-angled block can be slid down the wall until firm contact is made with the head, oriented in the horizontal eye-ear plane (top of external auditory meatus and inferior margin of bony orbit). If a scale bar must be used, it should be calibrated first, and again the subject urged to stretch and tapped in the lum-

bar region to facilitate this. An anthropometer is acceptable, but only in the hands of a trained person.

Weight should be taken, preferably on a medical type of balance scale, to the nearest pound; height to the nearest millimeter on an anthropometer, tenth of an inch on printed strips, or quarter inch if the scale bar is so calibrated.

Almost as important as current weight is weight history, as detailed as possible. Inquiry should be made—and checked by objective records, if possible—as to maximum weight, age when attained, its duration and cause (inactivity, illness, pregnancy), reason for weight loss, if any, and duration of current weight. It would be desirable to reconstruct weight during each decade of adult life. Weight can often be recalled in connection with athletic participation, military service, marriage, or pregnancy. Each figure should be specified as with or without clothing. Of course, such subjective data involve considerable error. A rough check on reliability is afforded by asking the subject his current weight before weighing, then comparing the two figures.

(2) Index of Body Build

Use of the data once obtained is not strictly within this subcommittee's purview, but the utility of the ponderal index, height/cube root of weight, as a simple generalized description of body build, is worth noting. Though not distinguishing between the fat and bony-muscular components of body bulk, its distribution is known in several sizable population samples, and promising correlations have been reported with occupational choice, physiology, and disease. Attention should also be drawn to the widespread but unfortunate custom of expressing perfectly good nude heights and weights as percentages under- or overweight, based on clothed standards of dubious applicability to the populations being studied.

(3) Skinfolds

These are useful, correlating about 0.70 with body fat and with endomorphy. An excellent instrument, the Lauge skinfold caliper, is available from the Wenner-Gren Aeronautical Laboratory of the University of Kentucky.

The two preferred sites for measurement are triceps and subscapular. Technic is extremely important, since slight variations in method and location of site can make major differences in readings. The technician must be trained and at least initially checked by a skilled professional. The same technician should take all the measurements in a given survey, if possible.

(4) Circumferences

Upper arm circumference at the level of the skinfold, chest circumference (in males), waist circumference, seat (hip) circumference, and maximum calf circumference are desirable. Of these, only the first is recommended as a minimum essential (but see below) by the National Research Council Committee on Nutritional Anthropometry. (Brozek, J. Body Measurements and Human Nutrition.(Ed.). Detroit, Mich.: Wayne University Press, 1956). These are all horizontal, with minimal pressure, and made with a millimeter steel (not cloth) tape, Keuffel and Esser "Wyteface" or Lufkin. All circumferences are measured three times, as are skinfolds, recording the best single figure. Chest circumference is measured during quiet breathing.

(5) Biacromial and Bi-iliac Diameters

Though recommended by the NRC Committee on Nutritional Anthropometry, and though theoretically useful in indicating laterality of build, these two skeletal dimensions alone have so far proved much less relatable to behavior,

physiology, or disease than ratings of morphological masculinity and femininity based on additional criteria. This is true whether these dimensions are analyzed separately, added, related to stature separately or combined, or when related to one another as an index of morphological masculinity. (Seltzer, C. C. Psychosom. Med. 8:75-97 (Mar.-Apr.), 1946); (Damon, A. and McFarland, R. A. J.A.M.A. 153:622-625 (Oct. 17), 1953); (Miller, D. C.; Trulson, M. F.; McCann, M. B.; White, P. D.; and Stare, F. J. Ann. Int. Med. 49:1178-1200 (Nov.), 1958). Furthermore, they require anthropometric skill and are worse than useless unless so taken. Since these measurements are currently being taken in several surveys, it may be premature to discard them until all the evidence is in. For the present, it seems best to retain them, along with upper arm circumference, as on the borderline between minimum acceptable and desirable, until their value is proved or disproved.

Unless biacromial and bi-iliac diameters can be measured accurately and reliably, which requires training, they should not be taken at all.

(6) Sitting Height

This is a desirable measurement, since it varies with sex, race, and body build, and since—by subtraction from stature—it provides a measure of leg length, a useful tailoring dimension along with chest, waist, and seat circumferences. In retrospective studies such as those current at the Johns Hopkins and Albany Medical Schools (Paffenbarger and Krueger, this conference), clothing size may provide data not otherwise available on body dimensions. With height and weight, such data permit an approximation to body build.

(7) Hand Grip Strength

This correlates about 0.57 with forearm girth, largely muscle (Lindegoard, B. Acta psychiat. et. neurol. Suppl. 86, pp. 1-163, 1953). Strength may also be related to energy expenditure.

(8) Photographs

These provide a permanent record of what the subject looks like. From photographs, reliable measurements of body diameters can be made, especially if the anatomical landmarks have been marked on the subject. One may also obtain somatotypes, hair patterns, "masculinity" ratings, and planimetric determination of body areas and even volumes, if front, side, and back poses are available. Since the strongest evidence for an association between body form and coronary artery disease comes from somatotyping, it seems logical to recommend this photographic technic (Sheldon, W. H. Varieties of Human Physique, 1940. Atlas of Men, New York: Harper, 1954). Other photographic technics may be as good or better, but none has received so extensive a trial (Tanner, J. M., and Weiner, J. S. Am. J. Phys. Anthropol. 7:145-186 (June), 1949, and Gavan, J. A.; Washburn, S. L.; and Lewis, P. H. Am. J. Phys. Anthropol. 10:331-353 (Sept.), 1952). The important point is to photograph at a standard distance, with a known magnification factor, and with the subject carefully posed in the three standard views. A 90° turntable is desirable.

(9) Research Technics

Research technics well worth investigating but not as yet suitable for epidemiological studies include methods for analyzing body composition in the living, such as densitometry, gas and dye dilution, body water partition, and radiography. (Keys, A., and Brozek, J. Physiol. Rev. 33:245-325 (July), 1953.)

The ultimate logical step is to study the mechanism underlying those associations between body form and cardiovascular disease which, with fur-

ther work, remain firmly established. One such research area being studied by Dr. Spain is the correlation between body build and endocrine status. Another is the correlation between body build and organ or tissue morphology.

Summary

Subject to later revision if warranted by experience, the following measurements of body form are proposed for epidemiologic studies of cardiovascular disease.

Minimum Acceptable Measurements

Height
Weight—plus weight history in as much detail as possible
Skinfolds—subscapular and triceps
Biacromial and bi-iliac diameters
Circumferences—upper arm, chest (in men)

Desirable Measurements

Seat, waist, calf circumferences
Sitting height
Hand grip strength—Collins-type dynamometer, carefully calibrated. Narragansett Gymnasium Equipment Co., Centralia, Mo.
Photographs—front, side, and back poses.

Conclusions

(1) We reiterate that when physical activity is of concern in epidemiological studies, knowledge will be required of average daily energy expenditure, the pattern of activity as regards peak levels and timing, and the physical environment in which activity is performed—all over a period of years.

(2) In many studies it will be desirable to know the physiological response of our populations to physical activity, in terms of cardiovascular strain involved in performance of accustomed activities, and of a standard work task. The best available single index of effective cardiovascular capacity is maximum rate of oxygen uptake (or the energy equivalent of such uptake).

(3) Our definition of energy expenditure levels in terms of light, moderate, and heavy, with caloric expenditure levels designated for each, is useful in epidemiologic studies. The description of the "standard man" to whom such caloric values apply, and a method of finding the equivalent caloric values applicable for "nonstandard" men are spelled out.

(4) "When feasible, records of dietary intake should be utilized to check estimates of total energy expenditure obtained from analysis of physical activities."

(5) The cardiovascular stress of physical activity may be more directly represented by an index which utilizes heart rate and blood pressure than by an index of caloric expenditure. In other words, energy expenditure does not always reflect heart work. However, one measure is not a substitute for the other. When an hypothesis calls for investigation of relationship between heart work per se and degenerative CV changes, a heart work index will provide the information that is most directly relevant. However, when biochemical or physical concomitants or by-products of muscular action are being examined in relation to cardiovascular changes, energy utilization is the information that will be most directly useful.

(6) We reiterate that minimum acceptable measurements necessary for description of body form are height, weight (with history), skinfold thickness and key circumferences, and diameters. Such information on morphology should probably be a matter of record in all studies of concern to this conference. The information will, of course, be essential in studies where the focus is on diet or activity. Other measurements of the given list are desirable when it is feasible to obtain them.

Recommendations for Research on Methodology

(1) Methods should be sought for determination of blood pressure during work. This would enable derivation of useful indexes of heart work based on appropriate combinations of heart rate and blood pressure values.

(2) Methods should be developed for monitoring and recording blood pressure and heart rate over extended periods. This would give information of value in judging cardiovascular cost of the complex tasks which make up a day's activity.

(3) The reliability of information obtained by various technics of questioning and interviewing on physical activity should be verified by direct observation.

(4) Means should be developed and validated for predicting maximum oxygen utilization without requiring maximum work. First efforts should be directed toward finding the reliability of predictions of maximum work capacity based on physiological responses to systematic increases in work load, from light to moderate.

(5) Statistical procedures for work sampling should be developed as a means for determining energy requirements of various occupations.

APPENDIX 1

Outline of Methods for Measurement of Physical Activity (with Key Reference)

1. Energy Expenditure (respiratory volume; oxygen utilization)—Estimate from oxygen consumption (with or without CO_2 production). Method involves metering of expired air, collection of total volume or aliquot sample, measurement of oxygen content (CO_2 content), computation of energy consumption as oxygen utilization x 4.9 (approximate) = calories energy. Weir has provided a refinement of computation which takes protein metabolism into account.[1]

Precautions: Arrange apparatus to encumber subject as little as possible. In describing energy requirement of a task, obtain repeat measurements, if possible on different subjects. Attempt at "showmanship" on part of subject can markedly alter level of activity and timing of task to point where representative values are not obtained. For high level activities, measure O_2 uptake by the so-called integral method[2]: at rest before, and during work and recovery, so that anaerobic as well as aerobic cost of effort may be assessed. Cost of work depends on the muscle groups involved; energy cost of locomotion depends more on body mass than surface area, so expression in KCal per unit weight is preferable.

(a) Classical method involves collection of expired air in Douglas Bag or spirometer, later metering and collection of sample for analysis, analysis of sample for O_2 and CO_2 with Haldane apparatus.[3,4]

(b) The Max Planck Institute at Dortmund has developed a device,[5,6] which meters expired air, withdraws 0.3 to 0.6 per cent of total for analysis. Device requires calibration at various rates of air flow.

(c) Wolff has developed an integrating Motor Pneumotachograph (IMP)[7,8] for measuring volume and collecting sample. It is the lightest device available and has been used continuously for periods of many hours. Sampling period should be more than 10 minutes.

(d) Pauling[9,10] has developed simple means for determination of O_2 in expired air depending on paramagnetic properties of gases. Dial reads directly in per cent or partial pressure of oxygen. Faster and requiring less skill than the Haldane method, accuracy is sufficient but not as good as Haldane.

(e) If required, CO_2 in expired air can be analyzed by infrared gas analyzer.[11]

(f) Time-weighting of individual tasks will usually be necessary to derive value for total energy cost of job. Example of procedures is provided by Morris.[12]

2. Pulse Rate

(a) By manual palpation. Radial pulse may not be accessible without disturbing work, in which case carotid may be convenient site of palpation. Postexertional pulses have meaning for certain tests of fitness, but should not be relied upon as index of grade of work previously performed.

(b) By EKG or cardiotachometer. Heavy muscular efforts and sweating make accurate measurement by these means difficult. Use of chest lead helps reduce "static."

(c) By pickup from photensensitive element, which follows changes in opacity of the ear.

(d) A general reference on these systems is provided by Dill.[13]

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APPENDIX 2

Check List of Items to Be Covered in Questionnaires on Physical Activity

- Off-the-Job Activities
  - Routine current activities—hours and maximum effort
    - Regular exercise—sports, walking, amateur, professional competition
    - Home maintenance
    - Hobbies
    - Transportation (walking to work, etc.)
  - Attitude toward exercise
  - Amount of sleep
  - History of physical activity
    - School and college, changes since—relate to weight history
- On-the-Job Activities
  - Present job—duration
    - Hours, vacations, lay-offs
    - Title
    - Job description—what do you actually do
    - Maximum efforts—rest periods—periods of intense activity
    - Proportions of sedentary, standing, walking, climbing, etc.
    - Heavy lifting—Heat stress
  - Previous jobs—general type and details as above—periods of unemployment
  - More than one job
  - Attitude toward job

SUBCOMMITTEE ON BIOCHEMICAL MEASUREMENTS

Forrest Kendall, Ph.D., Chairman

THE Subcommittee on Biochemical Measurements considers that its task in this conference is:

I. To discuss the place of biochemical measurements in epidemiological studies of cardiovascular diseases;

II. To set up criteria for judging the suitability of any specific biochemical measurement for such a study;

III. To outline the procedures required to achieve comparability of measurements made in various participating laboratories throughout the duration of the study; and

IV. To recommend a plan for implementing a system of controls necessary to achieve this comparability between laboratories.

I. The primary purpose of any epidemiological study is to evaluate the influence of diverse genetic and environmental factors upon the occurrence and severity of a disease. We all recognize that the achievement of this purpose in the field of cardiovascular disease is of the utmost importance and of the utmost difficulty. This is particularly true for atherosclerosis and hypertension. No one has succeeded in demonstrating specific etiological agents for these diseases. However, marked differences in the occurrence and severity of these diseases in different population groups support the hope that epidemiological studies may succeed in defining the factors which cause them. Two obvious difficulties of applying epidemiological technics to the study of these diseases are the chronic character of the diseases and their presence in occult form in a considerable portion of the population. Factors leading to the development of these diseases may be operative over a period of many years before clinical manifestations are recognized.

The problem would be simplified if it could be shown that a cardiovascular disease produces some characteristic biochemical change which appears before clinical symptoms become manifest and which disappears when the cause of the disease is removed. Much research in the field of atherosclerosis has been undertaken in the hope of showing that the concentration of some substance in the blood is as useful diagnostically in this disease as the level of glucose is in diabetes mellitus. The presence of abnormal deposits of cholesterol and other lipids in the lesions of atherosclerotic arteries has focused attention upon the relationship between serum lipid levels and the presence of diagnosed atherosclerosis. Studies have been made of the relationship between coronary atherosclerosis and the serum level of cholesterol, of phospholipid, of cholesterol-phospholipid ratios, of alpha and beta lipoproteins, of triglycerides, and of chylomicrons. Some degree of correlation has been found to exist between the level of each of these factors and the disease. Although the differences between the mean levels in diseased and control groups are statistically significant, the values for the two groups are distributed over very similar ranges and have little diagnostic or prognostic significance for any given individual.

It is interesting that this statement could have been made immediately after the publication of the first study of the distribution of serum cholesterol levels in the serum of patients with coronary heart disease and a control group. It was shown at that time that the serum

cholesterol values were distributed over similar ranges in both groups although the distribution curves tended to be skewed in favor of high levels in the coronary patients. Subsequent surveys have only served to confirm the original observation; they have added more points on the curve but the curves have not changed. It is unlikely that additional work to increase the accuracy of the methods for either sampling the population* or of determining the serum cholesterol levels will add substantially to the usefulness of serum cholesterol levels as a means for diagnosing the presence of atherosclerosis. Surveys that seek to relate biological levels with the disease are not strictly epidemiological studies in spite of the fact that large groups of the population are being surveyed. They still remain in the category of clinical investigations, because they do not relate the disease to specific environmental or genetic factors which characterize the population under investigation. The biological level of a substance in an individual is not necessarily a characteristic of that individual, but may reflect environmental factors.

In many studies, a biochemical determination has been substituted either for an adequate study of these factors or for an adequate appraisal of the clinical manifestations of the disease. This procedure is valid only if it is known with certainty that the disease is directly related to the biological level of the substance measured.

At the present stage of our knowledge, the assumption that the biological level of any substance is an etiological factor in the development of atherosclerosis may obscure rather than illuminate the significance of an epidemiological study. Thus, populations consuming high fat diets tend to show an increase in serum lipid level as well as an increased incidence of coronary atherosclerosis. These two phenomena may be related to each other only by occurring simultaneously in many individuals. The high serum lipid levels may be a direct result of the presence of large amounts of fat in the diet, while the development of the lesions may be due to some other environmental factor which varies systematically with changes in the fat content of the diet.

An epidemiological study should be so designed that the biochemical data are not introduced into the scheme of the study as an intermediate factor, B, associating A, the environmental and genetic factors, with C, the disease.

$$A \rightarrow B \rightarrow C$$

Evaluation of a possible relationship between B and C may be one of the purposes of the study, but the survey should be set up in such a way that the effect of A upon B and C is assessed independently.

The placing of cholesterol between the environmental factors and the disease has resulted in a widespread tendency in the medical profession to treat the hypercholesterolemia in their patients as though they were treating atherosclerosis. It has been found that various types of medication will result in a reduction of serum cholesterol levels. Nicotinic acid, for example, will reduce the serum cholesterol level and many other things will do it equally well. Epsom salts is as effective perhaps as nicotinic acid. Persistent diarrhea reduces serum cholesterol levels very well indeed, but does it cure atherosclerosis?

An outstanding scientist recently made the statement that he thought our preoccupation with serum cholesterol

* Choice of population samples for study of atherosclerosis poses many problems. "General populations" are depleted by deaths due to atherosclerosis and other diseases, but include many persons who have atherosclerosis without clinical manifestations. Better diagnostic tests would simplify sample selection.

levels had resulted in the most flagrant example of tubular vision he had encountered in the field of medicine, and that he felt sure that this preoccupation had prevented us from seeing and recognizing relationships that certainly exist between environment and the disease.

It is possible that the most valuable function of biochemical measurements in studies of this type is to permit the selection of certain segments of the population to be subjected to a far more complete analysis than can be applied to the whole population. Thus, studies of the background of the individuals who develop symptoms of coronary atherosclerosis in the presence of low levels of cholesterol and beta-lipoproteins in the serum, or of individuals who do not develop symptoms of the disease in spite of persistent high levels, may succeed in helping to define the epidemiological factors responsible for the disease.

II. To be useful in an epidemiological study, a biochemical measurement must fulfill certain minimum requirements:

(a) The level of the substance measured should not be subject to wide fluctuations dependent upon factors which cannot be controlled under the conditions of the study. To cite an example: The level of the unesterified fatty acids in the blood, which may turn out to be a very important factor in this disease process, is so dependent upon the dietary intake, physical activity, and emotional status of the subject that study of this important biochemical factor could not be expected to yield significant information in an epidemiological study without extraordinary care in setting up basal conditions.

(b) The concentration of the substance in the biological sample should not be subject to significant change between the time the sample is collected and the time when it is analyzed. This would perhaps rule out many determinations which might yield valuable information if proper preservative technics are not available. This is particularly true of the concentration of various enzyme substances in the serum.

(c) Analytical methods must be available that will yield reproducible results under all the working conditions likely to be encountered geographically throughout the study. Some methods which are satisfactory in temperate climates fail completely under abnormal conditions of temperature and humidity.

(d) The method selected should give valid results over the entire range of samples that might be encountered.

Thus, some methods for the determination of serum cholesterol levels yield invalid results when applied to lipemic or hemolyzed sera or to samples where the concentration lies outside a small, restricted range.

(e) The method selected should be one that can be performed with technical adequacy by the laboratory personnel available. Many methods which yield reproducible results in the hands of a highly skilled investigator are too difficult for the average technician.

III. The problem of insuring comparability of biochemical measurements made at different times and by different laboratories is not solved by the selection of a valid method. Reports comparing the values obtained by different laboratories for the concentration of various serum constituents in replicate samples of the same serum reveal that intolerable differences occur unless a systematic effort is made to insure comparability. This difficulty is not one that is unique to epidemiological studies. It exists wherever biochemical measurements are made. It may be due to internal factors existing in individual laboratories that result in failure to obtain consistent results from analyses performed on the same sample on different days. It may be due to external factors leading to differences in the analyses performed by the various participating laboratories. Precise informa-

tion concerning the cause of these difficulties is urgently needed.

In 1958 the National Heart Institute and the Communicable Disease Center initiated a pilot standardization program with the cooperation of five laboratories interested in epidemiological studies. The purposes of this project were: (1) to investigate the usefulness of statistical methods for the detection and control of factors which contribute significantly to variations in total cholesterol values within and among laboratories, and (2) to determine the practicability of using lyophilized human serum as a standard reference material for total cholesterol determinations. The study showed that statistical analysis of the results obtained by introducing a small number of previously analyzed samples in each day's workload permits rapid recognition of failure to achieve internal reproducibility.

The participating laboratories analyzed duplicate samples of lyophilized serum from each of four serum pools containing graded concentrations of cholesterol. The analyses were repeated every three weeks for a 15-week period. In this time three of the laboratories did not differ significantly among themselves. The fourth consistently reported higher values than the others. No secular changes were observed. These results suggest that lyophilized human serum can serve as a reasonable reference standard.

IV. Up until the present time every epidemiological study has had to find an independent solution of the problem of insuring comparability of biochemical measurements. The committee is of the opinion that the time has come when it would be economical for the organizations that sponsor this conference to take some action toward setting up a system to help achieve this comparability. We believe that this would be done best by the establishment of a central laboratory which would have the following five purposes:

1. To act as a central intelligence agency in order to maintain communication between laboratories and interested organizations carrying out specific measurements.

2. To prepare, characterize, preserve, and distribute standards which can be used in the calibration of particular methods. This is a particularly important function that should be taken over by a central organization. We all remember how a few years ago the service performed by the Bureau of Standards in providing accurate primary standards in many different fields of analysis played an important role in the development of chemistry in America. This function is no longer necessary in most fields but it is still needed in the field of biological chemistry. It may not be possible to buy a sample of cholesterol that is pure enough to depend upon as a working standard for the determination of cholesterol. Each individual laboratory seems to be expected to know just how to prepare this necessary primary standard from commercially available cholesterol. Provision of a cholesterol standard would help obtain comparable results from different laboratories. Trustworthy standards are even more important in other fields, e.g., reliable standards for measuring prothrombin time. If this central organization did nothing but provide standard materials to enable the participating laboratories to check their results, it would serve an important function.

3. To furnish consultative advice on biochemical methods to interested and qualified laboratories.

4. To compile and publish the experience and performance records of calibration studies.

5. To act as an international clearing house for the exchange of biochemical information pertaining to the solution of methodological problems.

COMMITTEE ON CULTURAL, SOCIETAL, FAMILIAL, PSYCHOLOGICAL, AND GENETIC INFLUENCES

Harry Kruse, M.D., F.A.P.H.A., Chairman

Introduction

THIS committee of the Conference on Methodology was concerned with cultural, societal, familial, psychological, and genetic influences in relation to cardiovascular disease. This postulated association is commonly based on the following assumption: cultural, societal, and familial situations may create stress in the individual leading to or adversely affecting cardiovascular disease. Why some persons react pathogenically to stress and why only certain of them have their cardiovascular system involved are questions usually explained by attributing this selectivity, in part at least, to genetic influences.

Implicit in this hypothesis is the belief that stress may either contribute to the development of coronary disease, or, at least, adversely affect the clinical course of the established disease. Although at present there appears to be no consensus on the relevance and importance of stress in heart disease, this possibility must continue to merit consideration until stress and its related circumstances have been demonstrated unqualifiedly to have little or no significance.

Unfortunately the concept of causation—and of stress for that matter—may be so vague or oversimplified as to be misleading. Today causality of disease is seldom visualized in the old simple relationship that A produces B. Rather a holistic concept of causation envisioning a constellation of diverse factors is held. Essentially these factors fall into three main groups: (1) those in the environment, using the term broadly to cover both the physical and social environment; (2) those in the host or individual; and (3) those associated with the adverse agent or process, whether it be an excess, a deficiency, or an interference. The multiple individual factors subsumed under these headings vary in their onset rate, intensity, and duration. Thus they have their own particular characteristics and functions in the constellation and make distinctive contributions to causation. Various names have been proposed to designate their characteristics and functions; for example, predisposing, provoking, precipitating, perpetuating, and conditioning factors, and antecedent circumstances. These names are, of course, not equivalent. But one of the most important points to be borne in mind is that a factor that alone cannot produce a disease can determine whether the disease is produced. With that in mind, it should be obvious that, in the present state of knowledge, the flat statement that stress has a minimal significance in heart disease is seriously misleading. Until it has been irrefutably demonstrated whether stress is an active component in the causal constellation, and until the nature and extent of its participation have been clarified, it is impossible to evaluate its significance with finality.

In its nature and its expanse, the subject of this committee possesses characteristics unlike that of any other committee of the conference. First, it com-

prises varied topics, each of which falls under a separate discipline. Each discipline has its distinctive group of specialists, vocabulary, and methodology. Second, despite this diversity, all the topics in this subject are interrelated. For example, here are natural pairs: physical environment and the individual; the group and the individual; somatic and psychological; environment and heredity. These pairs are interrelated not only horizontally but also vertically and diagonally. This complex interrelationship poses a problem. These topics are so closely associated that it is almost impossible to discuss each separately without some distortion arising from incompleteness. On the other hand, discussing these interrelationships necessarily involves repetition. Actually we should talk on all points simultaneously. But for present purposes that procedure would create grave disorder.

Third, although this is a Conference on Methodology, it was impossible in this section to exclude content. The design of any study depends on its objective; in turn, both the design and objective depend upon a hypothesis, which must be constructed from content. Then, too, inclusion of content was even more essential because of the multidisciplinary as well as intradisciplinary differences in subject matter, terms, and meanings. In consequence, this section had to be concerned with both the substantive and procedural phases of the subject.

The basic assumptions of the subject, its diversity, the interrelations and multidisciplines of its parts, and the operational sequence—all these considerations dictated the approach of this section. The subject was divided into four major topics, and the order of discussion followed the sequence outlined in the hypothesis describing their interrelation. These four broad topics were stress, environment (especially social environment), type of person, and genetics. Thus the discussion started with the individual, then moved to group phenomena and finally returned to the individual. In each topic, clarification and crystallization of content was sought before methodology was discussed.

From the standpoint of methodology, it is useful to restate at this point the sequence of events in the thesis to be investigated. It is desirable to ascertain whether cultural, societal, and familial influences produce stress that may be linked with cardiovascular disease. A two-stage operation would probably prove best: (1) the relation of cultural, societal, and familial factors to stress; and (2) the relation of stress to heart disease. Of course, it is possible to devise a one-stage operation which bypasses stress; namely, the relation of social environment to heart disease. Such a study would doubtless produce useful data; however, if the evidence were positive, the essential intermediate steps would be missing.

Stress and Adaptation

Because it occupies a central place in the course of events, the state of stress is the logical topic for first consideration. But there were also practical reasons. Enough is known about stress to warrant the supposition that it can serve as a valuable indicator of influences to be looked for in the environment. Furthermore, if stress is demonstrated to have any significant relation to heart disease, this fact becomes of utmost practical significance in the prevention and treatment of coronary disease.

In considering stress we are immediately confronted with its meaning and the number of terms associated with it and sometimes used synonymously: strain, load, pressure, tension. It is by no means certain that stress is the proper term for the phenomenon under discussion, but it would serve no useful purpose to cavil over terminology or to

draw distinctions in meaning. Nevertheless, its developmental history is informative.

Twenty-five centuries ago Hippocrates used the term stress in relation to disease, and, in general, the current biological concept is remarkably similar to his view. In the late seventeenth century the concept of stress came into prominence in physics in defining the properties of gases and solid bodies. On the biological side Cannon brought stress from the philosophical into the scientific realm by analysis of the biological reaction. His reaction test however was limited. From observations on experimentally induced stress Selye greatly extended the boundaries of the concept with his demonstrations and views of the alarm reaction, general adaptation syndrome, and local adaptation syndrome. Wolff and Hinkle further expanded the concept and filled in missing areas by their studies on the social environment, its effects, and man's reaction to it.

Currently the term stress is applied biologically to indicate the state in an organism which results from reaction to noxious stimuli or disturbing situations. However, the group expressed some reservations over this interpretation. In the group's opinion, stress itself is a concept combining both an abstraction and a generalization. As an abstract quality, it characterizes a number of bodily states. But the fact that stress is an abstraction is no reason to avoid consideration and use of the term. As it is usually described, it is well recognized. Hence, it was agreed that as the term is used in biology and medicine it has understandable meaning: man is facing difficulty. To impart that meaning, the term has usefulness. It was decided, however, that it would not serve present purposes to attempt to differentiate and separate different types of stress, such as acute or chronic, emotional or physical.

It is useful to describe the nature of stress, its meaning, its production, the adaptive reaction which it elicits, and its effects. It cannot be overemphasized that the topic encompasses a series of events with a potentiality for multiple processes at each stage.

Man is exposed to two different kinds of external environment: physical and social. Each in its own way exerts its influence on him, and each produces a different type of effect. Here we are concerned with the disturbing, not the beneficent, influences.

The physical environment, including what we call nature, has certain properties which affect man: heat, cold, electric shock, x-rays, pathogenic organisms, and toxins. By and large, as a class they have a distinctive mode of relationship to the body, of action, and effects: (1) They impinge directly upon the body; (2) they disturb energy transformation by bringing about an increase, or a decrease by withdrawal or interference; and (3) they may destroy cellular form and function.

Quite different is the social environment in its mode of affecting man. Its influence arises in situations and personal interaction. It is transmitted without direct physical contact with the body. Instead, stimuli are received by man's sensory system. Out of the multiple impulses in an experience, some are selected and summated. The ensuing sensations arouse associations, memories, and feelings. In short, perception and evaluations occur. As an ideational process, evaluation may not take place until some time after an experience. Usually there is a succession of ideational processes with temporal projections, both retrospective and prospective: memories, other imageries, both imaginative and anticipatory, and thought. Meaning and value judgments enter into the thought state and feelings are aroused. An attitude of dissatisfaction may develop in an affective state of unpleasantness.

In evaluating a situation, man takes into account the demands upon him and in turn his needs urging satisfaction, all organized in a setting of circumstances and conditions. For a variety of reasons, the person may regard a situation as unfavorable. To him it may appear to be threatening, alarming, overdemanding, restrictive, frustrating, conflictive, or unsatisfying. It is well to reiterate that whether a situation in the social environment imposes a strain on a person depends upon his conception and evaluation of it. Similar situations do not have the same meaning for all persons. Indeed, a situation rated by a detached observer as undisturbing may not be so regarded by a person involved in it. The opposite, strangely enough, is equally true.

To unfavorable influences from both environments, the body responds. Either a disturbing physical factor or social situation may act as a signal whereby the body reacts in an effort to neutralize, overcome, and nullify the unfavorable influence; to avert its further operation; and to restore the body to its usual state. This is the process of adjustment or adaptation, in which the body responds as a whole physiologically, biochemically, and psychologically; i.e., through bodily function, mood, thought, and behavior. Depending on the type of disturbance, the reaction is mediated at various levels of the central nervous system. For signals from a social situation, the brain acts as an adaptive organ, directing the mitigating, opposing, and restorative efforts of the body. Since all parts of the human system are subject to participation in this adaptive reaction, the tremendous potential of the brain for altering bodily function and behavior can scarcely be overestimated.

The capacity for adaptation is not the same in all persons; hence success in adaptation is variable. How well man reacts to a situation in the social environment depends in part upon his conception of it. When he perceives a life situation as oppressive, obstructive, or unsatisfying, he may not be able to make a favorable adaptation.

Somatic and psychological alterations occurring during adaptation may lead to diseases designated diseases of adaptation. Their production has been variously explained. It has been suggested that they occur as a result of inappropriate or overly sustained adaptation. Another view is that disturbances of bodily function, mood, thought, and behavior which occur during periods of adaptive effort make possible appearances of disease processes which might not otherwise manifest themselves.

Ackerman has described in detail his views on the psychological processes comprising adaptation and the sometimes pathological consequences. Three levels of phenomena are involved in the interaction between the individual and society: the structure of the environment; interpersonal relations; and the inner psychic life of the individual. Personality and society cannot be considered apart. Human behavior is shaped both by the organization of the internal forces of personality and the external forces of society. Social forces do not operate in a human vacuum, nor does personality exist in a social vacuum. Social forces are mediated through that phase of personality which achieves expression in group relations. Hence, in studying social phenomena, the most serviceable definition of personality is that which emphasizes the orientation to social participation.

The functions of personality are oriented in two directions: (1) toward the internal processes of the organism, and (2) toward the social environment. There is continuous interplay between the two relations. Together they constitute total personality. In its position of interchange with the environment, personality has a relative unity.

Society is the medium in which the

identity of a person gradually emerges. As the individual matures, he achieves an identity which is at once both individual and social. He has an individual self and a social self. The individual component of personal identity is represented in the more durable, less modifiable aspects of character structure. It is the core of the personality, the more personal, private, relatively fixed aspect of self. It reflects behavioral tendencies which have been conditioned by interaction of biological dispositions and family environment. The social component of a person's identity is represented in the less durable, more modifiable layers of character. It is less personal, less private, less fixed. It reflects behavioral tendencies which have been acquired later. It is these relatively more external layers of character which permit the greater degree of penetration by social forces. The social identity of a person reflects the continued interdependence of individual and society. For present purposes we are primarily concerned with this social self, representing those functions of personality which are externally oriented.

Those operations of the social self in the context of a given life situation may be called social role. Social role is the intermediate between intrapersonality life and group behavior, being that integrative aspect of the total personality which is expressed in social action. It implies the capacity of the personality to make fluid changes in form in accordance with the adaptational requirements of the individual's position in society. In a given time and social situation, certain components of the total self are mobilized into action and moved into a dominant position while other components are temporarily subordinated. In essence this is the process of social adaptation. By definition, social role is the adaptational unit of personality in action.

The psychic processes and combined components of behavior make up the configuration of social role. Orientation in this action phase of personality presupposes a set of goals and values commensurate with the individual's position in a given group. These values, which provide directives for social action are derived partly from the individual personality and partly from group organization; they are oriented toward both self and one's relations to other persons. Their dual orientation involves (1) personal attitude toward one's individual strivings, and (2) quality of apperception of culturally dominant patterns of interpersonal relations.

Out of the orienting-coordinating functions of personality and the surrounding group forces there is crystallized a specific pattern of action which is reflected in the form of a particular social role. Some of the components entering into the integration are: apperception of patterns of interpersonal relations; attempt to achieve gratification of inner needs; assertion or subordination of self; compliance with or protest against social pressure; effectuation of means for control of the environment; selection of particular defenses against anxiety; an effort to find solutions to personal conflict; projection of inner conflicts into the social role. These components determine value orientation and the corresponding configuration of the social role.

The relative success or failure of adaptation in a given social role is the result of coincidence or conflict between character disposition and social environment. There are numerous vicissitudes in the relation between social role and individual personality. First, it is assumed that the normal person has the capacity to effect flexibly a variety of social roles in accordance with adaptational requirements. But persons vary in the extent of their repertoire and they may be required to assume roles

beyond their range or out of character.

Second, the degree of psychic distance between the individual and social selves is significant. In emotional content, the social role may be peripheral or central to the individual self; hence it may have central or peripheral significance in relation to the individual's emotional life. Such relations will determine the degree to which an individual's identification with a group is genuine or false, spontaneous and healthy, or forced and anxiety-ridden.

Third, the amount of anxiety generated is influenced by the degree of harmony or conflict between individual identity and social identity. The person's inner concept of self either may coincide with the aspect of self-projected into a particular social role or may clash with it. In the event of conflict, anxiety is generated, with profound effects on social role. It may induce increasing instability and a tendency to rapid change of roles. Or it may induce increasing rigidity. In either event, adaptive efficiency is impaired. Thus the personality performance in a given social role is affected by the relative harmony or conflict between the social expression of self and the inner evaluation of self.

In this process of social adaptation, the individual may react to social pressure in four ways: compliance, protest, withdrawal, new integration. It is the latter reaction which is of particular interest. New integration occurs when social pressures are overwhelming and exceed the individual's resources for pliable adaptation. Sometimes the dilemma of more than one role brings on the crisis. This situation occurs when a person faces two antithetical roles and is incapable of assuming either; or when he must perform two roles but their conflicting nature prevents performance of them. The consequence of the unresolved conflict between the emotional content of antithetical roles is an adaptive breakdown of the characteristic and usual social role. Then the person responds with integration of a new form with distinctive properties of its own. This process seems to occur in the development of the so-called psychosomatic disorder.

Through physiological arrangement in the course of adaptive reaction, any bodily function subject to the regulation of the central nervous system might be influenced to a significant degree. That regulatory influence might be mediated directly by any of the nervous pathways, by internal secretion, or indirectly through changes in the over-all behavior of the individual. Also, the physiological changes brought about during adaptation to life situations may include release or production of conditioning factors contributory to the occurrence of disease. Hence the association between adaptive reaction and incidence of illness may be explained on reasonable grounds. This recognition of the adaptive reaction to a social situation as either a precipitating or perpetuating factor in disease imparts to this relationship an importance in prevention and treatment.

Whatever the explanations, diseases have been produced experimentally as the consequence of adaptation. Similarly, incidence of illness in persons has been associated with life situations conceived by the individual as disturbing and involving the adaptive reaction. In one study it was found that at least one third of all episodes of illness were influenced in their time of occurrence, or in their course, by the attempts of persons to adapt to situations. From this same investigation came the view that the majority of all occurrences of illness in adults are influenced to some degree by efforts to adapt to the social environment. Hence it has been concluded that man's susceptibility to illness is to a large degree influenced by his relation to society.

This conclusion is not surprising inasmuch as the state of the host has long been recognized to have an influence on the occurrence of illness. Exposure, and extreme fatigue are conditions believed to be conducive to the occurrence of disease or to adversely affect its course. Reaction to a disturbing situation surely also represents an altered state of the host.

To carry the sequence of events to completion, it should be stated that not all persons reacting to a situation contract the same type of illness. Just as a similar situation does not affect all persons alike, those who do react with an associated illness do not develop the same disease. Although man's relation to his social environment exerts a major influence on the occurrence and course of illness, it has relatively little influence on the type of the disease. Rather the type of disease is believed to be determined by various other influences: (1) The physical environment and opportunity for exposure to particular pathogenic agents and conditions extant at that time and previously; (2) the genetic constitution of the person. The variability in these factors could be responsible for the differences in the type of disease developed.

Enumerating a few of the various diseases associated with adaptive reactions, such as ulcers, colitis, asthma, and cardiac disease, probably brings the word "psychosomatic" to mind. Actually no qualitative differences have been found between diseases in their relation to social adaptation. Whatever difference may exist appears to be quantitative; that is, certain diseases appear to be more readily and therefore more frequently and more profoundly influenced in their course by the physiological effects of adaptation than are others. These have gained the name "psychosomatic diseases."

This account presents a working hypothesis that fits the available observations. It can form the basis for establishing a number of objectives in investigations designed to test the proposition that a relationship exists between social environment, physical environment, genetics, and coronary disease.

Methodology—With this background the group turned to consideration of objectives and the methodology most appropriate for achieving them. Specifically it discussed the detection of stress and means for measuring its intensity. When it is considered that stress may be induced by a variety of means, that stressors impinge or gain entry to the body at very different points, that in reaction the body uses various systems and processes—physiological, biochemical, and psychological—it is by no means certain that stress is a simple homogeneous quality. Certainly recognition of its possible heterogeneity and complexity gives no encouragement to finding a single test, let alone a quantitative method. It was agreed that stress cannot be directly distinguished. It was admitted therefore that there is no measure of the state of stress per se in the body.

The problem was then approached by considering the relations of stress. One is the reaction to it. Can stress be detected by its effects? This question was discussed in different terms; namely, the measurement of intensity of stress by indexes or indicators. Reaction to stress, it will be recalled, comprises numerous functional changes involving physiological processes and behavior.

Some of these changes have been proposed and used as indicators of stress. Changes in metabolic rate, blood pressure, pulse rate, oxygen consumption, blood clotting, mood, or behavior were mentioned. But it was decided that none of these indexes measures stress. Corticoid excretion and blood levels were regarded as being more related to stress and therefore better indicators, but their limitations were acknowledged.

It was thought that extensive measurements of these indicators in relation to stress would not be productive. In the opinion of the group, there is no simple indicator which provides an objective measure of the intensity of stress. It was pointed out that future research may provide such an indicator. For example, changes in the hypothalamus seem to be close expressions of stress. But a method for evaluating these changes is not now ready.

The group then turned to the antecedent relation to stress, namely the factors producing it. A test was cited in which type and load of work were used as indicators in measurement of stress.

Hinkle proposed that a combination of both relations, the antecedent stressor and the subsequent reaction, be studied. Here the stressor was designated the challenge. It was proposed that the challenge be discovered in the constellation of circumstances in the environment, both physical and social; that this challenge be evaluated; and that the reaction to the challenge be studied.

In an investigation of the relation of atherosclerosis and hypertension to personality and the social environment, the complexity of this area and the use of the term "stress" should not obscure the fact that the epidemiological methods here are essentially no different from those used in other medical studies. At the start a hypothesis should be formulated about certain events or processes within the cardiovascular system which are thought to be relevant to atherosclerosis or hypertension and about the way that these processes may be modified by nervous, endocrine, or behavioral influences as the individual reacts to his total life situation. As the dependent variables, some measures of the cardiovascular reactions are used. As the independent variables, one can measure "objective" features of the life situation, features of the individual which indicate that he "perceives" a given situation in a certain manner, or features of the individual (whether socially, culturally, or psychologically determined), which make it likely that he reacts to his life situation in a certain manner. The experimenter counts, classifies, and seeks associations, as in any other epidemiological study.

The same considerations of experimental design, selection of sample, and reliability of indexes that apply in other studies apply here. The experimenter should try to avoid naive assumptions (such as that primitive societies are less complex and less stressful). He should try to classify like with like (and not to assume that Negro school teachers are the same as Negro laborers). He should try to call phenomena by their precise name (and not to call "anxiety" "stress"). He should try to report results in terms of observations (e.g., responses on a psychological test) rather than as conclusions or diagnoses (e.g., hysterical personalities).

With the help of skilled behavioral and social scientists specific answers to specific questions can be obtained.

In the same vein Ackerman suggested that the psychosocial representations of stress might be approached operationally in the context of the individual functioning within the family, the family within the community. This approach requires procedures for systematic psychodynamic study of the ongoing interactional processes of the individual patient with his family group. It is assumed that the individual patients would undergo traditional forms of psychiatric and psychological study. Beyond that, however, there would be systematic examination of the family phenomenon, its internal organization and external adaptation to the surrounding community. The individual patient is then viewed as a living unit within that group. Necessary to such an approach is a dynamic concept of the in-

tegration of personality into required family roles. The phenomenon of breakdown and illness may be seen both as a function of the individual organism and as a function of the familial organism. Of special significance in this connection is the relationship between the emergence of illness and the interplay of individual and family group defense against anxiety.

In an attempt to correlate specific defense operations, anxiety, and somatic pathology, it is necessary to look into the conflict, tension, and anxiety aroused by a threat to a person's integrity. Perhaps particular configurations of subconscious conflicts and frustrations may be found to be related to disease. But the experience of conflict alone is no index of functional breakdown with illness. It is essential to note how man perceives a threat in a situation and how he considers which of his resources might be mobilized to protect him and control his tension.

Every human being experiences functional distress in a particular way. Hence it is no surprise to observe certain reactions in the inner organ system. When there can be no release of tension in the voluntary muscles, it may flow over into the sympathetic and parasympathetic systems. That is an inappropriate kind of mobilization of defense against tension, a failing type of mobilization. Such inappropriate mobilization suggests that there might be a relationship between acting out and acting in. The phrase "acting out" signifies a situation in which a person is experiencing a conflict in a distressing way; he cannot cope with it; and in an irrational and inappropriate way, elements of that conflict spill over into society in such a manner as to get him into trouble because his action does not fit the social situation. Although the consequences may be unpleasant, for the moment the individual has succeeded in relieving the excessive tension and has established an equilibrium for his internal life. However, it is possible to conceive of a situation in which the individual would like to act out but does not dare. Such a situation would elicit different types of defense behavior, some indicative of well-being and some which are pathogenic, either psychically or somatically or both. It would be profitable to conduct studies on the mobilization of healthy or pathogenic defenses and their possible relation to disease.

Rather than attempt to work out the sequences of changes in the development of coronary disease with special inquiry into stress, Dr. Selye would go directly to a study to determine whether substances found experimentally to protect animals from cardiopathy would confer a like protection against coronary disease in man. He reported his experimental observations, recommending that they be put to clinical test. Dr. Selye asserted that combined treatment with certain steroids and electrolytes produces a cardiopathy characterized by necroses. The steroid was regarded as a conditioning factor, i.e., it conditioned the heart for production of the cardiopathy by the electrolyte. Among all steroids tested only certain corticoids had this capacity. As a conditioner 2-methyl-9-chlorocortisol (Me-Cl-COL) possessed the highest potency.

Following conditioning of animals with the effective steroid, certain electrolytes could induce the necrotic cardiopathy. Only certain sodium salts, specifically monosodium phosphate, sodium sulfate, and sodium perchlorate, had this ability. Other sodium salts were inactive. It was concluded that both the cation and the anion possessed this sensitizing potency.

Certain other electrolytes actually prevented development of the necrotic cardiopathy when they were given simultaneously with sensitizing electrolytes to animals suitably conditioned with steroids. Among all the salts

tested, potassium chloride and magnesium chloride were the most potent protectors.

In all experimental animals used—rats, guinea pigs, monkeys, and dogs—this reaction has been produced. It is fair to assume at least that a chemical mechanism for it exists in man.

Distinct from the cardiopathy produced gradually by the persistent action of corticoids plus certain activating sodium salts is the sudden eliciting effect of stress. Although pretreatment of rats with threshold doses of Me-Cl-COL plus NaH_2PO_4 produced little or no cardiac damage, subsequent exposure to the stress of neuromuscular effort immediately elicited severe and extensive cardiac necroses in all experimental animals. Under the same experimental conditions of pretreatment, various stress-creating maneuvers similarly induced a high incidence of myocardial necroses. Neither Me-Cl-COL nor stress alone produced cardiac necrosis. But after pretreatment with Me-Cl-COL, alone, i.e., without sodium salts, numerous, quite unrelated agents creating stress had a cardiotoxic effect. Hence the eliciting action of stress was regarded to be nonspecific. The precipitation of infarct-like myocardial lesions by sudden exposure to stressors is of special interest in view of its clinical implications.

After pretreatment of rats with Me-Cl-COL a single intravenous injection of papain extract produced myocardial necroses more readily than otherwise.

It is highly significant that KCl and $MgCl_2$ are effective in preventing the various forms of cardiopathy produced by the following different means: (1) corticoids and sensitizing Na-salts; (2) corticoid-conditioning followed by exposure to various stressors; and (3) intravenous injection of a protease. These observations raise the hope that they may also be beneficial in preventing cardiopathies in man.

It was stated very clearly that the experimentally induced cardiopathies do not reproduce all the histopathologic changes presently regarded as a sine qua non for the development of coronary disease. For example, there is no atherosclerosis. Hence, pathologically none of the experimental cardiopathies in animals is an analog of coronary disease in man.

Nevertheless, since both potassium chloride and magnesium chloride exert protective action against various types of myocardial pathology induced experimentally by different means, Dr. Selye believes that this fact warrants testing of their efficacy in preventing coronary thrombosis in man. Furthermore, it would be a safe and simple procedure. There are three types of procedures commonly used in ascertaining etiology and treatment of a disease: (1) experimental production of the disease, usually in animals; (2) test treatment of the naturally occurring disease in man; and (3) test prevention of the natural disease. If patient studies on the protective action of the electrolytes were undertaken, the preventive type would provide critical data. In addition, so many lives might be saved that such tests are justified even if the likelihood of success seems small.

Environment: Culture

Having considered stress, we now turn to its environmental sources. It is obvious that both the physical and social environments may cause stress. Because the influence of the physical environment was scheduled to be discussed by another section, our attention was focused primarily on the social environment as a source of stress. Yet so intertwined are the two environments, that the physical environment was mentioned at appropriate points.

It must be remembered that society cannot be considered separately from personality. Human behavior is shaped

both by the organization of the internal forces of personality and the external forces of society. Indeed, the two are interrelated throughout life. Environment has a molding effect on character structure which varies with the distinctive features of each society. At each age level and at each stage of personality organization, the environment requires distinct types of social function from the individual. Hence social environment contributes to the shaping of adaptive behavior by determining the path along which the individual may successfully adapt to his surroundings. It reinforces some individual drives and subordinates others. Current factors in the environment influence the social levels of personality integration and may even penetrate to the individual personality.

The social environment is also the medium for situations which are the sources of stress. But again the situation cannot be considered separately from the participating personality. The situation derives its meaning from the participant's interpretation. It has been found that a participant in a situation evaluates its stress-provoking quality differently than does a detached observer. It may have a meaning and significance for the participant that does not enter into the observer's evaluation. Hence the problem becomes: How may personalized stress-creating situations in the social environment be detected and identified and how may their relation to cardiovascular disease be studied?

Specialization has brought about a division of the social environment into culture, society, and the family. It is therefore most convenient to consider the nature and methodology of each division separately; yet the three become commingled when any one is subjected to study.

Culture comprises the customs, manners, way of life, and conventional wisdom of the group. This way of life includes innumerable details of behavior which represent the normal anticipated response of any of the society's members to a particular situation. Norms of behavior and opinion constitute a culture pattern. Culture as a whole is a more or less organized aggregate of such patterns. It provides members of any society with an indispensable guide in all the affairs of life. It would be impossible either for them or for society to function effectively without it. It operates with a background of social approval and social pressure.

There are many types of culture in the world. Broadly speaking, they differ in their homogeneity and simplicity. Even within national borders, whether in sections or in smaller subdivisions such as districts, variants of the basic culture may appear. Since the anthropologist in his studies is often concerned with the cultural homogeneity of a sample, he sometimes has to separate population groups into subcultures and even into further fractions. Because of cultural heterogeneity, studies in the United States were regarded as most difficult by the late Ruth Benedict. New York City itself offers an impressive array of subcultures.

Dr. Shapiro emphasized that the most important property of culture is the learned patterns of behavior. By that is meant the patterns that people live by, the expectations they have in the behavior of other people in their own community. These cultural patterns confer the ability to carry on a relatively large series of behavioral patterns in a semiautomatic way. By providing a way of routine living, these patterns spare man the necessity of constant decision. Because once a pattern is established and expectation built up for most of the events in daily life, man can proceed in a predetermined way without giving much thought to it. This proce-

dure is, of course, a saver of time and of emotional wear and tear on the individual; for having to make fresh decisions for every item of behavior would indeed be time-consuming and enervating. Man comes to take his cultural pattern so much for granted that most of the time he does not think about its operation. Then, when he encounters a situation which is different, he thinks of it as being very odd, strange, and peculiar.

No matter how well regulated a society may be, how well understood the cultural patterns may be by members of the community, there is always a residuum of conflict, which may arise anywhere in the social order, to provoke emotional stress. It was Dr. Shapiro's belief that a highly educated society, in which the people have a variety of rules and statutes to contend with, may contain many more stress-creating situations than does a primitive organization. For example, being a member of a minority group, or exclusion from a social class, or operation of economic factors that are flexible and open to manipulation beyond what the cultures might be expected to control—all these things as they appear in the more highly developed society give rise to more situations which could produce stress than occur in a bushman society, where there is not much economic distinction between the members of the society, where there are no classes, and where there are no minority groups. Obviously even there some situations which would lead to stress would occur, but the number would be fewer.

Methodology—It is appropriate to describe briefly the way a cultural anthropologist works: his methodological approach, once he has selected his population sample. His objective is to provide an account of group behavior in all activities of living. But such an area of observation is vast and complex. Culture itself has a multitude of components each comprising numerous details. To add to the difficulty, an individual may differ in his behavior, if ever so slightly, from time to time; and individuals may differ even more from one another. Thus a real culture pattern is a series of varying behaviors, although the range of variation is usually within moderate limits.

This variability of behavior yields data that are much too bulky and unwieldy to be descriptive and workable. Hence the anthropologist develops a culture construct pattern by establishing the mode of the series of variations within the effective range of a real culture pattern; he then uses this mode as a symbol for the real culture pattern. The total culture construct is obtained by combining all the culture construct patterns. This procedure provides a concise and convenient approximation of the conditions existing within the real culture. It is a serviceable method for summarizing group behavior in the activities of living.

It has been repeatedly emphasized that whether a situation is stress-provoking depends on the conception of a person involved in it, not on the judgment of a detached observer. Since the situation thus derives its value from the participant, the anthropologist as a detached observer cannot directly, unerringly, and assuredly detect and identify stress-bearing situations. At best he can study each culture separately and select those situations that might be stress-provoking.

Cultural patterns of behavior are the concrete expressions reflecting generalized meanings or values. Because of their influence on behavior, value orientations play an important function in the lives of individuals. Professor Clyde Kluckhohn defines value orientation as "a generalized and organized conception, influencing behavior, of nature, of man's place in it, of man's relation to man, and of the desirable and nondesir-

able as they may relate to man-environment and interhuman relations."

Florence Kluckhohn has developed a conceptual scheme which will permit a systematic classification of cultural value orientations as they pertain to universal human problems. This scheme sets forth central types of value orientations and the ranges of their possible variability. It is based upon two assumptions. The first is that there is a limited number of basic human problems for which all peoples at all times and in all places have had to find some solution.

Five of these common human problems, regarded as being of key importance, were stated in the form of questions:

1. What are the innate predispositions of man? That is, what is his basic human nature?
2. What is the relation of man to nature?
3. What is the significant time dimension?
4. What is the valid personality type?
5. What is the dominant modality of the relationship of man to other men?

The second assumption underlying the scheme is that solutions found for the problems are variable, but that the variability is within a range of possible solutions. She recognizes three types of solutions for each universal human problem. This scheme permits a systematic comparison of societies or subgroups on the basis of man's conceptions of fundamental and universal relationships.

Dr. Shapiro acknowledged the validity of the types of value orientations. However, he believed that their application in observations on individuals might be difficult because they are abstract. As a more useful procedure, he prefers to deal with specific, everyday situations.

Dr. Shapiro enumerated several examples of likely sources of stress in cultures. Mother-in-law avoidance in some American Indian societies is a custom which might be a source of stress; whereas in our society with its mother-in-law jokes, the situation is not the same. On the other hand, social mobility is probably a source of much difficulty in our own society, but it does not exist in Polynesia. There the natives are not fired with ambition to become tycoons. Polynesia has no tycoons, so the natives have no particular desire to be one. Indeed, Polynesia has no social classes and corporations; hence, it has no high pressure executives. Prestige and sexual jealousy occur in both cultures, but in quite different character. Certainly stress occurs in all societies. What should be underscored is that the origin of the stress may vary not only with the conception of the affected person but also from one society to another. Even when societies are apparently similar they may not be, because of the different overtones.

Dr. Hinkle recounted observations from a cross-cultural study of health patterns in groups of Chinese, Hungarian, and American college students. Cultural differences were observed in their attitude toward work, relationship to father, and getting ahead. He raised the question whether the type of attitude might be associated with a cardiovascular reaction pattern related to the development of atherosclerosis.

Dr. Shapiro pointed out the danger of overgeneralizing on the basis of observations from a subculture. For example, getting ahead has a very high value rating among a very limited portion of the Chinese population, but it is by no means typical of all Chinese. Nor are all Americans driven by overvaulting ambition and high aspiration. Since there are subcultures in both China and the United States, it is risky to use subcultural patterns in making broad generalizations about Chinese and Americans. It is necessary to ascertain how general a pattern is in a culture.

Three other types of studies were re-

garded as likely to yield significant information:

Because of inadequacies in published data, it would be desirable to conduct cross-cultural studies on blood pressure.

Concerning hypertension, it would be useful to study cultural groups in which persons have a desire to act out but fear to do so because of the consequences, as contrasted with other cultures in which it is permissible to act out freely.

Interrelationship normally provides the individual with some degree of protection. In our society this system is not working as well as it might. It would be helpful to study groups in which the culture normally provides varied degrees of reinforcement. The individual should be studied in relation to the family and to the larger culture. In this comparison of cultures, possible relationships with cardiovascular disease should be tested.

To Dr. Shapiro the paramount question in methodology was how to evaluate stress in one culture in comparision with stress in another. It is a difficult problem because the personal reaction appears to outweigh the particular situation. For example, is the Chinese boy striving for scholastic prestige under the same kind of tension and pressure as an American youth attempting to climb in a business organization? It is conceivable that the two situations require different types of adaptation. Whether one might be associated with a significant change in cardiovascular function is a matter for testing. Above all, it would be helpful to have an objective, physiological measure for evaluating the stress-provoking potency of situations. Then they could be more readily identified and compared in different cultures.

Some caution should be exercised in the consideration of broad cultural factors associated with stress as possibly related to heart disease. Specifically, the following conceptions and practices are to be avoided:

1. Lumping all threats or strains upon the individual under the encompassing term of load, stress, or challenge. It would be better in any anthropological investigations to make observations on more limited and specific phenomena, i.e., fear, rage, dilemmas of decision, ordeals of endurance or tolerance.

2. Failure to differentiate as far as possible between the phenomenon of culture and the phenomenon of society. For research purposes, there is an advantage in keeping them conceptually and somewhat operationally separate.

3. The popular and largely false assumption that the relatively primitive and preliterate societies are "simpler" and less "stressful" than are our sophisticated and civilized societies. Their "stressors" may be more intense than ours, and some of their components may be more complex (language, kinship systems, and so forth). We can be certain of finding wider cultural contrasts in primitive societies, but not so certain of finding greater simplicity of components or potential "stressors" for personal experience.

4. The easy assumption that culture and society are primarily "offenders rather than befrienders" to persons subjected to stress (fear, etc.). The primary function of culture and society is to solve or resolve a people's problems. Most sociocultural systems do a reasonably adequate job of it.

5. A tendency to neglect or ignore the utility of a balance between stress-induction and stress-reduction mechanisms within a sociocultural system (ghost-fear).

6. Failure to properly differentiate between a homogeneous and stable culture and a heterogeneous and/or changing culture. There is an apparent tendency for the "reduction mechanisms" of culturally-induced stress to break down more rapidly than the "induction mechanisms."

7. Failure to recognize and account for the fact that culturally induced stress is subject to modification by the "significant reference" group members and

by individualized personal experience (family).

8. Failure to allow for, or to take advantage of, the phenomena of cultural selectivity in socially conditioned stress induction and stress reduction.

9. Possible lack of adequate recognition and utilization of existing sociocultural variation in family size and structure.

10. Possible lack of recognition of the research potentials of cultural variations for testing the hypothesis of "acting-out" and "acting-in" of stress-frustration.

Environment: Society

Concurring in the statement that no societies are free from sources of stress, Professor Simmons went even further in saying that it probably would not be possible for a society to survive without sources of stress. As society's means to stimulate and control action, stress has a survival function. Professor Simmons described a procedure for identifying stress-provoking situations by "peeling off" layers of perceptive interpretations of them. A list of critical situations with a potential of creating stress in the life of man in his culture is prepared for a particular society. Three questions are then applied to each situation. Would it induce stress because of its physical elements? Is its stress-inducing nature reasonable only in the light of the culture? Is there any aspect of the situation provoking stress that is not explainable by either the physical environment or human culture and dependent upon the special experience and idiosyncrasies of the participating individual? In short, these questions seek to ascertain whether the stress-inducing nature of the situation has a basis of physical or cultural realism as shared by other members of the society.

When applied to the Hopi Indians, it was surprising to find little in the physical environment that served as a realistic source of stress. Yet it was obvious that in their lives the natives experienced much stress, mostly cultural in origin. Certain situations also had stress-productive aspects that did not seem to make sense. Deeper investigation revealed that the natives had been conditioned to fear particular situations. It was then possible to place much of the seemingly illogical and unintelligible in the category of culturally realistic stress-bearing situations. Furthermore, it was observed that although the natives are subjected to culturally determined stress potentials, their stress is resolved by other cultural provisions. Thus, the culture creates stress-provoking situations, but it also provides protective measures against them.

From these observations Professor Simmons concluded that it is necessary to look searchingly into both the culture and the person's life history to discover what patterns conditioned his fears. It may be necessary to slice the culture into such "subcultures" as occupational, ethnic, religious, and familial aspects in a given society.

The usefulness of social variables in society for epidemiological studies might be considered on the basis of their possible relevance to stress or cardiovascular disease: e.g., the nature of the social system; social status with processes of social stratification, social interaction, and social mobility; and social roles, whether they be ascribed, achieved, adopted, or assumed.

Other sociological variables used in various studies and found to be significant are: social class, type of residential area, occupation, identification in the general population, authority, leadership, responsibility, and affectional ties. To these may be added the following variables: size of group, forms of internal communication, rules determining rights of members, methods of assigning tasks and handling grievances.

A program of sociological research

into the epidemiological factors possibly associated with cardiovascular diseases might profitably follow the plan which is outlined by Dr. Simmons, with steps taken somewhat in the order named. If undertaken by sociologists, it should be under the constant counsel and guidance of a medical team of persons who are recognized as experts in cardiovascular disorders.

A general ecological approach would be recommended as preferable, particularly in the initial stages of the study. Study should be concentrated on a particular geographic area containing a reasonably wide range of factors suspected to be significant in predisposing persons to cardiovascular diseases. In addition, the factors considered (biological, social, cultural, familial, psychological, etc.) should be those for which fairly reliable technics of differentiation and/or measurement are available. It would also be preferred that an area where a considerable number of good ecological studies have already been made be chosen in order to take advantage of the accumulated ecological knowledge existing on the area. Good examples would be New Haven, Conn.; Providence, R. I.; Framingham, Mass.; or Evans County, Ga. Other areas might be selected later to serve as areal controls or for comparative purposes. The chosen area should be sufficiently representative to make possible the gathering of data on the various factors listed below, or at least a selection of them.

A representative sample should be taken of the entire population of the area as of a specified date. This sample would serve as the base line and population from which all the succeeding data would be drawn for analysis and correlative tests.

Every member of this sample (with provisions for substituting members for drop-outs or those failing to cooperate) should be subjected to a competent medical diagnosis to determine the presence of cardiovascular disease both in clear-cut instances, when there is no doubt of the actual presence of the disease, and in cases of border line, incipient, or potential existence of the disorder. Others should be medically identified as clearly free of any recognized symptoms or indications of incurring the disease. These would serve as controls or for panel or cohort studies in long-term perspective. The ill and "potentially ill" would be classified according to degree or type of complication, age, and other categories to be studied as the research progressed. Probably special attention would be given to the middle-aged and younger categories and only general attention paid to the aged persons.

Some order of priority or sequence should be established in the making of statistical checks on incidence or prevalence of the disorders as correlated with existing social factors. An order such as the following might be followed: sex; racial or ethnic grouping; rural or urban residence; ecological areal placement in the region studied; immigrant generation; religious affiliation; social class position as specifically or operationally defined—family structure, stability, and status as operationally defined; extent of social mobility as operationally defined, etc.

When these gross statistical correlations have been carried as far as feasible, on the basis of findings, intensive interviewing of stratified, sampled, and perhaps paired respondents should begin for much more detailed and definitive studies. These could be made on a "one-shot" cross-sectional basis and on a long-term periodic "panel" basis. Such factors as shifting age status, economic stability, family equilibrium, social mobility, diet, "stress-components," and so forth, could then be studied in the context of case history and life history as well as the sociological context.

This is perhaps as far as it is at all useful to suggest possible design for an

ecological study. "Next steps" all along the way would be influenced primarily by the findings from the steps previously taken.

Environment: Family

In the vast social structure, a key unit is the family. It is a primary group intermediate between the individual and wider society. Here in this smallest and closest social group, culture, society and the genes meet. Family bonds are made up of a fusion of factors: biological, psychological, social, and economic. The family has a natural life history of its own; on the other hand, every person in his lifetime has several different families, one for each period of his life.

Among the number of social purposes that the family serves, two will be particularly mentioned: (1) It determines the forms of behavior that are required in the fundamental and prominent roles within it; and (2) it provides training toward integration into a wide range of social roles and acceptance of social responsibility. Specifically, family relationship controls the quality, quantity, and direction of emotional expression; it regulates and patterns the form and range of opportunities for security, pleasure, and self-realization; it develops a sense of responsibility for the welfare of others; it teaches evaluation of suspected danger in a situation; it intensifies or lessens anxiety; and it influences the choice of defenses against it.

Obviously, to fulfill these purposes, stability of the family is important. The stability of the family and its members hinges on a delicate pattern of emotional balance and interchange. The behavior of each member is affected by every other member. The degree of stability in family relationship is the end-product of complex, interdependent processes; for it is governed by the interaction of family members in their respective family roles. One requirement for stability is maintenance of continuity of identity. Against this are balanced the requirements of capacity to change through receptivity to new experience and learning; to achieve further development; and to fill new life roles. Effective adaptation requires a favorable balance between this protection of continuity and accommodation to change. The homeostasis of behavior—the balance between continuity and change, the clinging to the old and receptivity to the new—is influenced in turn by the capacity to cope with conflict. Operating to prevent a conflict, to establish a protective equilibrium, or to compensate for conflictual effects is the pattern of family role relations called complementarity. Failure to find an effective solution for control of conflict leads to adaptive breakdown which engulfs all members of the family.

Through faulty functioning the family may become a source of stress, or fail in its support of a member already under pressure outside the home. When a family becomes disabled and its operations impaired, its stability is threatened. Usually such impairment in performance is not total, but partial. Some components of family functioning maintain their integrity, while others are disabled. Families exhibiting deterioration may be thought as of progressively failing to carry out their essential family functions. Ackerman has devised a system of grading families which expresses quantitatively the extent of their disability.

Breakdown in the psychological operations of the family group does not occur all at once. Initially it may be relatively localized and may be manifested in impairment of the family's capacity for problem-solving and decision-making. In the beginning the disintegrative effects of breakdown may be relatively subtle, but by degrees they spread progressively to affect more and more of the family's basic functions. At this point manifestations of breakdown and

disorganization are so unmistakable as to be easily detectable: isolation of family members; critical barriers to communication; conflict and hostility disintegrating family unity. With these developments, the family as a group can no longer fulfill even its minimum functions.

During the course of deterioration, efforts may be exerted to halt or reverse it. Families vary in their capacity to contain those problems for which they cannot find a solution, while endeavoring to make some tolerable restitution. Such compensatory behavior is possible only when, despite conflict and alienation, some family pairs are able to maintain a satisfying pattern of complementarity. In one way they may damage one another, yet in another they may provide material support and satisfaction of mutual needs.

Not to be overlooked is the relationship between family conflict and psychological conflicts within a member. This relationship is a basic influence on both individual and family stability, for the stability of the individual personality is partly dependent upon the stability of the family. Here again complementarity in family role relations fundamentally influences the course and outcome of personal conflict.

Stress in the family has focal points that are readily recognizable. As a group the family develops a major pattern in its difficulties. In some, the major area of stress centers in the marital relations; in others, in parent-child relations; in still others, in the struggle to reconcile the requirements of multiple roles, or to establish the position of the family in the wider community. Stress and conflict emerge when the behavior of a member in one family role fails to complement the needs of the member in the reciprocal role.

Methodology—It is difficult to correlate culture or personality with either stress or somatic illness unless the reference group is also interpreted, for most influences upon the individual are registered through the intervening network of interpersonal relations. The family is one of the most influential groups. Accordingly, the individual should be studied not in isolation but within the framework of his ongoing experience and interchange with the family group. In that context, personality and life histories of individuals may be studied in relation to stress and somatic illness.

In an examination of the family in its relation to stress and somatic illness, it is clear that all elements must be included: the individuals, the family group, and the various interrelationships. In particular this examination should cover the following areas: each member's personality; his interactions both within his family group and outside with the wider social unit; the internal organization of the family; its performance of functions which influence each member by inculcating both family roles and the social responsibility which comes with wider social roles; and the external adaptation of the family to the surrounding community.

When a person conceives of a situation as disturbing or threatening, he reacts with tension and anxiety. In this circumstance he considers which of his resources may be mobilized to protect him and to allay his anxiety. In order to understand the personalized, disturbing element in the situation and the individual's reaction to it, it is necessary to look into the individual's personality, conditioning, and defenses. But the individual is an interacting member of his group; hence, it is essential to study him and his life in the context of his group.

In a study of the family as the related group, certain points should be observed: major areas of stress; presence of conflict; state of stability or deteri-

oration; performance of basic functions, especially support of a member who may have anxiety; and interplay of individual and family-group defenses against anxiety. It is necessary to measure the extent of psychic resources for control of anxiety both in the individual and in the family group; and to correlate the defense behavior of the individual with that of the network of close relationships, since the latter composite plays an essential part in the mobilization of defense against the effects of anxiety. Somatic breakdown is related to the success or failure of these defense operations. In fact, it is impressive to note the apparent correlation between crises in somatic functioning and the release of acute anxiety because defenses break down. Thus, when the individual is studied within the family group, it is possible to relate the occurrence of illness to an episode of anxiety and to breakdown of defenses.

Ackerman has developed a method of examining the family and has published a detailed guide for its application.* His examination includes the following behavior components: the relative autonomy of the individual; his emotional integration into family group, that is, the adaptation of his personality to the required family roles; the fit or lack of fit for the same individual of significant familial or extrafamilial roles; the extent to which the reciprocal role behavior of other family members supports or threatens the stability of the individual; and the psychological identity and value orientation of the family group and its external adaptation to the community. Data obtained on these points provide the basis for determining the nature of three interrelated sets of processes: (1) What goes on inside the individual; (2) what goes on between this individual and other significant family members; and (3) psychosocial patterns of the family as a whole.

Several reported investigations on illness in relation to the family have concentrated on one or another aspect of family life: e.g., the role of cultural values; situations of crisis.

The Individual: His Personality and Psychological Reactions

We now return from the environment to the individual and his susceptibility to both stress and heart disease. It has been postulated that certain individuals are more vulnerable to stress; of these a certain number appear to be prone to develop coronary disease or its circulatory precursor. For two reasons this subject has practical significance: (1) the elucidation of factors responsible for the development or precipitation of heart disease; and (2) the ability to predict the probability of the occurrence of heart disease and to make early identification of probable victims as a basis of prevention.

Vulnerability to stress and vulnerability to coronary disease are two different characteristics; yet, because of their possibly significant association, they may profitably be studied either separately or jointly. A person's relation to stress exhibits two aspects: (1) his sensitivity to stress, i.e., the appropriateness, frequency, and intensity with which a person conceives of situations as disturbing; and (2) the nature of his reaction to that stress. It is possible that a particular type of reaction to stress may be one of the factors influencing the occurrence or course of heart disease. Such a sequence would explain in part any vulnerability to the cardiac complex.

Is there a particular personality type associated with development of heart

* Ackerman, N. W. Life Stress and Bodily Disease: Character Structure in Hypertensive Persons. Res. Publ. A. Nerv. & Ment. Dis. 29:900-928. Baltimore, Md.: Williams & Wilkins, 1950.

disease? What are the characteristics of such an individual? These seemingly simple questions open a very large and complex area. The meaning of personality itself has been an elusive subject. Allport has compiled more than 55 definitions of personality which have been proposed at one time or another. Since the method of distinguishing personality types depends upon conception of the nature of personality, it is theoretically possible to have a different method for every definition.

Actually four studies have reported on personality type and heart disease or some associated sign such as hypertension. Usually, these studies were conducted after signs had developed. Accordingly, the significance of the reported observations has been questioned. Did the observed personality pattern precede or follow the occurrence of coronary disease or hypertension? Or, did the same factor or set of factors that produced heart disease also bring about the personality change? It may be said at this point that investigators believe that the personality structure has been laid down long before the appearance of heart disease.

It will be recalled that Wolff and Hinkle found that whether a situation is capable of inciting stress in a person depends upon his perception of the situation, its meaning, and its value for him. This point of view is in harmony with the possible vulnerability of an individual to stress.

After reviewing those observations and conclusions which bear upon the topic of vulnerability and characteristics of the vulnerable, Dr. Hinkle proposed a type of procedure to obtain further knowledge. People differ in their susceptibility to illness regardless of its nature. Those who became ill most frequently were found to be more likely to develop both more varied illnesses and more severe illnesses than those who became ill less frequently. All types of illness seemed to occur somewhat more frequently during periods when the individual was having difficulty in adapting to the total configuration of his life. It is to be expected that a man's adaptive reaction patterns will exhibit a variety of alterations depending upon his own constitution, previous conditioning, and the circumstances he encounters. Consequently, it it understandable that he would develop a variety of illnesses.

It is reasonable to assume that cardiovascular disease might be among the disorders arising out of man's interrelation with his environment. As he goes through life, man might have an adaptive reaction pattern that is reflected in the function of his cardiovascular system, and if continued over a sufficient period of time, this pattern might produce disease. Thus, men developing cardiac pathology will not necessarily be different from those contracting other illnesses, except possibly in one or two characteristics of the specific adaptive reaction pattern relevant to the cardiovascular system.

Hinkle pointed to the need to find out more about the characteristics, both physiological and psychological, of persons with cardiac disorder and their reactions to situations. More specifically he proposed trying to identify: (1) the nature of the challenge in the situation, (2) any peculiarity in the evaluation, and (3) the nature of the cardiovascular reaction pattern. He pointed out the desirability of taking general hypotheses, developed on evidence from the laboratory, out into the field. Unfortunately, in atherosclerosis and heart disease the laboratory evidence on which hypotheses may be built is quite limited. Possibly the best hypotheses at hand were derived from limited laboratory observations on persons placed in relatively acute situations to which they responded. In these studies, measurements were made over a rather short

period of time on a limited number of variables.

One such hypothesis would be: In short-term experiments persons may be subjected to situations which are designed to threaten them. As part of their reaction, some of them will develop elevations of blood pressure. Some persons, perceiving their life situations as threatening to them, also exhibit an adaptative reaction which includes an increase in peripheral resistance with elevation of their blood pressure. If this adaptative reaction were carried on over a long period of time, it might ultimately produce hypertensive cardiovascular disease.

How does one identify persons who are prone to this type of reaction? A proportion of the people who react in this way seem to have a singular mental pattern which makes them easily threatened by a variety of circumstances. They react to this situation with an aggressive feeling which they have difficulty in expressing.

Not all of these persons necessarily have anything abnormal about their cardiovascular apparatus. Many people in the population who have this personality trait do not have hypertension. On the other hand, a significant number of hypertensives do not have this trait. Nevertheless, it is probable that this trait occurs more frequently in hypertensives.

One way to test this hypothesis would be to study cardiac morbidity rates in populations which differ in their conceptions of certain threatening circumstances, i.e., whether they see themselves as threatened. For this it is necessary to turn to the anthropologist. It is a reasonable assumption that certain societies facilitate in their members ready expression of the aggressive response elicited by such threats, while other societies hinder it. Some people are in a situation in which their treatment by society is likely to arouse in them a great deal of hostile resistance which they cannot express because that would only make the situation worse.

Another hypothesis may be cited: When certain people are faced in life with situations that they regard as threatening, the biologic response will include a significant rise in the blood cholesterol. If this metabolic reaction pattern is sustained over a period of time, it is conceivable that it facilitates the development of atherosclerosis.

In a certain number of people, this type of adaptative reaction is associated with mobilization. This raises the possibility that it is the striving members of our society who are particularly susceptible, those who get up earlier, work harder and longer, and keep going all the time.

To test this thesis, again we turn to the anthropologists to identify societies in which this pattern seems to be prevalent and other societies in which it is not.

From studies over a number of years of the personality characteristics of hypertensive patients, Ackerman has developed a hypothesis. In evaluating the character structure of these patients, he has placed special emphasis on their defense behavior and role adaptation. They exhibit, he has noted, a pyramiding series of specific shock reactions in the personality, representing the responses to experiences conveying real or symbolic threat. In these reactions the processes for control of emotion are acutely overwhelmed, and the adaptive functions of the personality undergo impairment or breakdown. Specifically, the defense mechanism of repression proves inadequate; auxiliary defenses which are then mobilized also are insufficient. With this paralysis of the adaptive processes, a state of temporary emotional disorganization is induced. There is a loss of balance in the integrative functions of the personality at all levels. This inadequacy is reflected in

the failure to maintain a characteristic social role which is significant in the preservation of security in interpersonal relations. It is assumed that the potentiality for this particular form of shock reaction depends on the specific pattern of emotional predisposition conditioned by the vicissitudes of experiences during the formative stages of personality. Thus, there is believed to be a basic factor of vulnerability in the personality which long antedates the emergence of overt symptoms of hypertension.

The generalized impairment of adaptive capacities in this shock reaction is transitory. The loss of emotional control, while profound, is brief; equilibrium is quickly restored. After a series of such critical episodes, precipitated by traumatic life experiences which symbolically spell a danger, the presence of hypertension is often revealed. Its onset is associated with a pyramiding series of specific shock reactions in the personality. In the later stages, fixation of the distortions of adaptive function of the personality is seen, involving increasing rigidity of the psychophysical mechanisms of the personality. The component of conflict which is primarily related to the hypertensive reaction is that which occurs between the person and the environment, rather than the person's conflict with self. In sum, it is believed that a preexisting vulnerability in personality, plus the reactions to traumatic life experience produce the condition in which blood pressure is elevated, at first reversibly; later permanently.

From his study of hypertensive persons Ackerman has gained impressions of their personality. Their behavior suggests that they would like to "act out" and to behave like psychopaths, but do not dare.

"Acting out" signifies a situation in which a person is experiencing a conflict which causes him distress and which he cannot cope with in a rational and appropriate way. Thus his manner of resolving this conflict is likely to get him into trouble because his action does not fit the social situation. From that action unpleasant consequences may ensue, but for the moment the individual has succeeded in relieving the excessive tension and has established an equilibrium for his internal life.

The behavior of a psychopathic personality illustrates "acting out." He is a highly egocentric person who is antisocial, gets into trouble with his surrounding social group, is against everything laid down by prescribed social behavior, defies tradition, and gets into trouble with the law. The psychopath acts as if he were more powerful than the forces of his environment. He acts senselessly as if he had some magical power to make himself stronger than anyone else in his social group.

In characterizing the personality of the hypertensive patient as a "would-be psychopath," Ackerman stated that such a person is motivated in phantasy by a desire to live like a psychopath. But he does not dare. The fear of retaliation is overwhelming. So, he does not have the ability to master the environment with hostile aggressive power. On the other hand, he is not able to accept and execute a role of submission to and dependence on the environment. Obviously the two roles are incongruous and irreconcilable. That is his dilemma.

Hence he "acts in." It is no surprise to observe reactions in the inner organ system. When tension cannot be released in the voluntary muscles, it may flow over into the sympathetic and parasympathetic systems. It is, however, an inappropriate, failing type of mobilization of defense against tension.

Ackerman has explained the psychological processes underlying this behavior. One prominent manifestation in a hypertensive person is the overtense conflict experienced in the effort to control aggressive impulses and the ten-

dency to suppress the translation of such impulses into action. Suppression occurs because the usual defenses are unsuitable and defective. Attempts to cope with impulses through repression are unsuccessful and auxiliary defenses also are inadequate. It is not clear that this pattern of defective repression is specific for hypertension; it may prove to be a common pattern in a variety of psychosomatic disorders. Conscious suppression of emotion represents the final defense against the threat of loss of control. If the basic impulses were to break through the control mechanisms and be discharged into action, it is likely that the resulting behavior would be either psychopathic or psychotic. When psychosomatic phenomena appear instead, it is believed that they represent a substitute for a break-through of emotional control with direct translation* of impulse into action.

The component of conflict which is critical in the hypertensive phenomenon and possibly in other psychosomatic disorders as well, is that which takes place largely at the level of translation of conscious or preconscious emotional experience into action, i.e., the level at which the patient struggles with some degree of consciousness to act against the presumed dangers of the environment. The patient's reaction reflects a strenuous effort to control or even actively reshape the environment, whether at the level of reality or at the level of omnipotent mastery. The implied urge is to mobilize magic power in order to coerce significant persons into a protective and supportive role. It therefore seems that the externalized rather than the internalized component of conflict is specific and crucial for hypertensives.

In the process of adaptation social role may represent either a positive expression of individuality, that is, role and personality may coincide, or a negative function of defense. In the latter case, the effort to execute a particular social role may exact an excessive price in the terms of conflict and anxiety within the individual. Or the inner conflict may be such as to damage or actually prevent the execution of a given social role.

The relative success or failure of adaptation in the context of a given role is partly the result of coincidence or conflict between a particular character disposition and a particular group environment with its status and role.

For these reasons, the relations between personality and environment have much significance in the development of hypertension. It would appear that the link between emotional reactivity and the hypertensive response, i.e., psychological specificity, is to be sought, not in the content of conflicting drives, nor in the total personality configuration, but rather in the specific pattern of defect of the mechanism of control of emotion in a situation of undue stress between the person and the environment. All that has been said suggests a focus of interest on the structure of the social environment, and on the ego-regulatory mechanisms of personality in hypertensives, especially the precise defenses which they employ against impulse discharge and anxiety. Accordingly, any psychological specificity is to be sought in those mechanisms of the hypertensive person which integrate emotion and control translation of impulse into action in the performance of a social role. In short, the emphasis is on role adaptation and defense behavior.

It thus becomes necessary to ascertain: (1) the particular ego-integration patterns and defense employed in a given role; (2) the degree of adaptive efficacy or failure; (3) the manner in which such defenses are periodically overwhelmed; (4) what forms of compensatory defense are erected in the phase of recuperation following a temporary break-through of emotional control.

To obtain this information in testing the validity of the hypothesis, the usual psychoanalytic approach is inadequate. It does not provide a sufficiently accurate cross-section appreciation of total character, in particular those patterns of character integration that in a given time and given environment are projected into a given social role. Actually psychoanalysis is not oriented toward examining the social self. Rather it has tended to emphasize a denuding by the patient of the social layers of his identity in order to gain access to the unconscious and biologically conditioned drives. Thus it keeps in abeyance the very ego-integration that would be a principal object of study in hypertensive persons.

Ackerman has devised a guide for the evaluation of total personality function in the context of the present time and the present life situation. It stresses patterns of ego-integration oriented to the maintenance of a given social role or roles in a given environment. He emphasizes that the personality should not be disassociated from the environment. Rather the two should be treated as a functional entity. The picture of the patient's personality should be unified and dynamic, and his functional relation with his environment should be preserved. Ackerman suggests that this mode of analysis might profitably be applied to a larger group of hypertensives.

Professor Carney Landis offered still another approach to determining the characteristics of persons who develop cardiac disease. He pointed out that most scientific discoveries have resulted from someone's asking the right question. For effective results from direct interrogation, a set of relevant questions must be designed for the occasion. If he were to undertake such a type of study on cardiac disease, he would first obtain from a number of cardiologists what they thought were the relevant questions. Then he would design the interview.

The biggest obstacle to such an inquiry by direct questioning is the scarcity of suitable interviewers. It should be strongly stated that interviewing cannot be turned over to unskillful and untrained persons. It takes a long time to find and train competent interviewers.

In order to discover the characteristics of persons vulnerable to heart disease, Professor Landis would question two groups: (1) persons with undoubted hypertension, and (2) those who had had a coronary attack. He would ask them pertinent questions to find what their life experience, psychological problems, and social relationships have been.

To the protest that many coronary patients could not or would not submit to an interview, Professor Landis maintained that any question can be asked if it is asked in the right way and under the proper circumstances, and it will be answered.

He recommended that the application of any tests should come only after completion of the survey by interview, never before. Only after the relevance of questions in the interview has been confirmed, is it possible to prepare tests, for the investigator must apply tests that are relevant to the intended use. In his opinion there is no available psychological test which has any relevance and therefore any primary value in cardiovascular disease. On these grounds, he would not apply the Army Alpha, Rohrschach, or Thematic Apperception Tests. Nevertheless, he thinks that after the survey by interview has indicated the pertinent questions, it should be possible to design tests with the requisite relevancy for cardiovascular disease.

Worth noting is Professor Landis' estimate that to properly conduct a study by direct questioning would require 15 years.

Genetics

At the outset of consideration of genetics in relation to heart disease, two

points should be kept clearly and emphatically in mind. In a sense they are the present-day doctrines of genetics. One principle is that what is inherited for the most part is a potentiality, not an inevitability. Whether this potentiality develops into an actuality depends primarily upon environmental circumstances. Thus genes do not exert an absolute control but determine potential development in particular environmental situations. The second principle, which is really a corollary of the first, recognizes that genes and environment are interrelated, that an interlocking network of hereditary and environmental influences determine the outcome.

Conceivably, genetics may influence in several different ways the development of coronary disease; it may act structurally or functionally at various stages of pathogenesis. This possibility raises a number of questions for investigation. In general, the numerous relations and questions concerning them may be grouped in three major categories.

The paramount question goes right to the crux of the matter: Is there a hereditary predisposition to coronary disease? To answer this question requires a direct over-all approach which does not necessarily cast any light on the mode of relationship. But its answer would provide fundamental information which would have practical application in the prevention of heart disease.

Aside from its value per se, the answer might dovetail with knowledge of specific points in the hypothesis of the sequence in pathogenesis. Determination of whether there is a vulnerability to cardiac disease for which genetics has at least a share of the responsibility might complement existing partial evidence on the sequence of events in pathogensis; in consequence, to that extent it might place the hypothesis and its parts on a more substantial footing. Out of the group of persons with an adaptive reaction leading to frequent illness from a variety of diseases, why do only some persons contract heart disease? What is the basis of this selectivity? To answer this question it is important to find out whether certain persons inherit a potentiality for developing coronary disease. Surely it would also stimulate a number of investigations on specific points. For the over-all approach, available methods such as study of hereditary lines or twins are well known.

The second large question concerns the possible distinctiveness of persons who will develop coronary disease, and the genetic transmission of this quality. Can such individuals be characterized in a prototype? Are there recognizably distinctive characteristics associated with a person who tends to develop coronary disorder? Are these features transmissible? Demonstration of an association between a distinctive type of person and his vulnerability to heart disease raises the question whether his characteristics have any hereditary basis.

There have been a number of efforts to type persons who develop or have coronary disease, for valid typing would be extremely useful. It would provide an index for identifying potential coronary victims so that preventive measures might be instituted. Furthermore, although typical characteristics might not explain the pathogenesis of heart disease, they might furnish a clue to the significant features of the process. If the characteristics were found to be under genetic influence, the usefulness of typing would be enhanced on both scores.

For present purposes, it is desirable to know whether well defined, easily recognizable characteristics validly significant and specific for coronary disease are available for use in genetic studies. Attempts have been directed at two bases of distinguishing persons: body type and personality. Gertler and White have re-

ported that coronary disease occurs more frequently in persons with endomorphic mesomorph body build. Technics of physical measurements and a number of systems of classification of body type were developed long ago. The selection of significant physical measurements and the validity of the systems of classification have been the objects of critical comment and differences of opinion.

Four studies have been conducted on the personality type associated with persons having hypertension. Briefly stated, the present attitude is that it is less promising and less profitable to establish personality type associated with coronary disorders than to investigate the psychological reactions, especially role adaptation and defense behavior, of persons who develop hypertension and coronary disease.

The third area of investigation by genetics has to do with the various pathological changes in heart disease suggested, reputed, or demonstrated to be under genetic influence. They may be arranged in four groups: psychological, physiological, biochemical, and histological. At one time or another eight different changes have been speculatively associated with genetic influence. It is to be borne in mind that, for the most part, the relation of these changes to genetics is at present a postulation. These changes are shown in the following tabulation:

Psychological	Biochemical
Role adaptation and defense behavior	Hypercholesteremia
	Lipoprotein
	Blood coagulation
Physiological	
Vascular hyperactivity	**Histological**
Transient hypertension and tachycardia	Arterial wall width
	Defect at junction of intima and media

From examination of this tabulation it is obvious that genetics may be related to three levels of cardiac disease according to the nature of the pathology: structural, functional, and metabolic. Hence, genetic methods must be applied in conjunction with morphological, physiological, and biochemical technics.

Only four changes were considered in detail by the group: adaptive reaction; a lesion at the junction of the intima and media in the coronary artery; lipoprotein; and blood coagulation.

Why some persons react to stress with illness, but why only certain of these develop cardiovascular diseases are questions usually explained by attributing this selectivity, in part at least, to genetic influences. These questions make pertinent the investigation of the possible relationship of two separate phenomena to genetics. One of these phenomena—namely, genetic influence in the selection of the heart as the vulnerable point—has already been discussed.

Now the nonspecific adaptive reaction comes under consideration. Here the objective is to ascertain whether the adaptive reaction and its apparent responsibility for vulnerability to illness, as indicated by the frequency with which it is associated with illness in particular individuals, is determined at least in part by genetic processes. For present purposes, vulnerability to illness is of interest only in so far as it indicates the type of adaptive reaction that is responsible. It is assumed that this reaction could lead to cardiovascular diseases or any of a number of others, depending on different factors. As such it may be regarded presumptively as one stage in the pathogenesis of cardiovascular disease. If this type of adaptive reaction is conducive nonspecifically to heart disease, it is important to ascertain whether this reaction has a genetic basis, i.e., whether certain persons inherit a potentiality for developing it. But to establish a genetic relation to any characteristic, one must have a reliable means of identifying that distinctive feature. At present there is no quick and sure

means of accomplishing this identification. Hence application of a genetic approach awaits perfection of an identifying method.

Next to be considered were the processes relevant to the development of atherosclerosis and thrombosis and conceivably affected by genetic influence. In describing the formation of the atherosclerotic plaque, Dr. Wilkinson pointed out that two theories have been proposed to explain the origin of the early deposit. One postulation is that there are always circulating in the blood tiny thrombi which may attach themselves to the vessel wall; one does attach itself and starts to organize; during the process of organization, fatty infiltration and calcification occur. The second postulation about the process of atherogenesis, called the infiltration theory, has wider acceptance on this continent. According to this theory there is a constant flow of fatty particles from the inside to the outside of the vessel. But for some reason in atherogenesis, infiltration builds up at the junction of the intima and media of the coronary artery, and lipid material collects to constitute a formation. In composition this material at first closely resembles the circulating lipids of the blood, i.e., the lipoproteins. As the lipid infiltration ages, its composition changes; relatively more cholesterol and less of the other lipids are present. If this infiltration progresses, it becomes a yellow or lipid plaque. As this lipid plaque ages, scarring and calcification may occur until very little lipid material is left. The resulting pearly plaque is composed of fibrous tissue and calcium.

Atherosclerosis is widely prevalent; most adults are found to exhibit it. In the two sexes there is probably no difference in the total amount, but there is a difference in distribution. In the male, the coronary artery is more frequently involved; in the female, it is seldom affected until after the menopause. It is postulated that atherogenesis in the coronary artery is associated with an inherent defect at the junction of the intima and media, and that this defect is an inherited characteristic.

Despite the widespread prevalence of atherosclerosis, it is only when a complication, such as the formation of a thrombus on the eroded surface of the plaque, sets in that clinical disease may be said to have occurred. For this reason, the amount of atherosclerosis is not so important as the chance distribution of it.

Various factors influence atherogenesis. The rate and manner of formation of the plaque is affected by primary and secondary factors. Age and sex are primary factors. With age there is a tendency toward increased atherogenesis. Quite apart from the effects due to hormonal differences are the anatomical effects of sex on atherogenesis. At birth differences may be distinguished between male and female coronary arteries, both in thickness and in anatomical configuration in the heart. These primary factors favoring the female would probably account for from 2 to 3 per cent of the difference in death rates for coronary disease between males and females if there were no secondary factors.

Among the secondary factors affecting atherogenesis may be mentioned hypertension, diabetes, renal disease, hypothyroidism, hyperlipemia, and hypercholesteremia. Hypertension is probably the most important factor in the list. Of the remaining factors, hyperlipemia is of special note because of its relation to the clinical disorders. In effect those metabolic diseases that increase the rate of atherogenesis remove the female sex protection. For example, female diabetics at any age are just as likely as nondiabetic males to have atherosclerosis. The one common denominator in the metabolic conditions that remove the female sex protection is a secondary hyperlipemia.

Genetically determined hyperlipemia appears to be indistinguishable from secondary hyperlipemia. With the hope of comparing within family groups the effect of hyperlipemia, nine genetic types have been postulated. In setting up genetic studies it is important to find the carrier states. Hyperlipemia is noticeable in the homozygous. It may also be observable in the heterozygous individual by the time he is 30. Dr. Wilkinson emphasized that if every person between the ages of 25 and 35 merely had his blood inspected and his diet adjusted if he were found to have hyperlipemia, from 3 to 10 per cent of potentially fatal coronary diseases could be prevented. When all the possible secondary factors in the development of the atherosclerotic heart are studied, it may be that some of them will be found to be just as important as hyperlipemia or even more so.

Medical genetics is in the midst of an extraordinarily active and fertile period, largely the outcome of investigations into the biochemical backgrounds of disease. Accordingly, Dr. Block presented the biochemical approach to genetics with special consideration of lipoprotein patterns and heart disease. Before indicating promising lines of investigation, he reviewed the biochemistry, transport, and intermediary metabolism of lipoprotein.

Total lipids in the blood comprise neutral fat, cholesterol, cholesterol esters, and phospholipids. In the blood stream these lipids are carried in combination with protein. These lipoproteins make up from 12 to 15 per cent of the total proteins in normal human plasma. Serum protein itself is composed of two heterogeneous groups of proteins—albumins and globulins—but it may be further fractionated. Electrophoretic analysis of serum protein yields a diagram containing five to ten protein boundaries, depending on the type of fractionation. Each boundary is indicative of a separate group of proteins. The first boundary represents albumin; the remaining boundaries, globulins. In order, the latter are designated alpha 1, alpha 2, beta, and gamma. About 75 per cent of the serum lipids are carried in combination with the protein in the beta globulin fraction. Only a small proportion of lipids is carried with the alpha protein fraction.

How lipid and protein are combined and how tightly they are bound are not exactly known. It has been suggested, although not proved, that there is a core of protein with active groups of amino acids on its surface. This core holds these molecules together through attractive forces between nonpolar peptide residues such as leucine and phenylalanine and the fatty acids of the lipid moiety.

What happens to lipoprotein in the blood stream in the utilization of lipids? It has been postulated that there is a normal level of lipoprotein in the blood. That level is exceeded when lipoprotein is unable to take up more neutral fat; that point is the high level of lipoprotein-fat combination. Then from tissue an enzyme or clearing factor, lipoprotein lipase, is released. When it comes into contact with the lipoprotein, it splits off the neutral fat fraction in glycerol and fatty acids, thereby regenerating the protein to be available to pick up more lipids.

In the biochemical approach to the study of genetic influence in any disease, it is necessary to select a specific characteristic to be investigated. In the present instance it may be a lipid constituent of the blood, such as neutral fat. Whatever it is, its validity and significance is usually established through its occurrence in patients with clinical signs of a particular disease. Also blocks and aberrations may occur in several ways and in various stages in the metabolism of a substance. For one thing, the metabolic block may be found to be asso-

ciated with an enzymatic aberration. Whatever the detectable abnormality, the specific characteristic is traced genetically. Sometimes the tracing is best undertaken in genetically isolated groups.

Block pointed out that a metabolic abnormality may be found in either of two stages: biochemically manifest or latent. In some persons it may be readily detected by an appropriate biochemical method; in others, it is in a so-called carrier state, which may be revealed only after special measures. For full and complete application of genetic principles, detection of the carrier, or susceptibility, state is highly important. Perhaps one way to reveal this state is to impose an appropriate stress or overload upon the subject. Two examples illustrate the point: When a family is being studied for occurrence of phenylketonuria, the abnormality will be found regularly in the urine of some members, but will not be detected in others. However, Jervis has indicated that the administration of phenylalanine to patients with this disorder may lead to an abnormal phenylalanine tolerance curve. Another means of detecting early evidences of diseases which develop late in life is a technic devised by Conn and Fajans which utilizes stress for the recognition of susceptibility to diabetes. In both examples, the susceptibility, which would otherwise go unnoted, is detected by a form of stress. Emphasized was the possible usefulness of detection of the carrier state in studies of heart disease. Practically, detection of the carrier state opens the possibility of delaying or preventing the manifest disease.

Block proposed three studies in a biochemical-genetic approach to heart disease. In one, the objective would be to measure the clearing ability of the sera of persons with hyperlipemia. Normally the enzyme lipoprotein lipase cannot be detected in the blood. But if heparin is injected into the subject, his blood shows within five minutes a rapid increase in its ability to clear neutral fat, i.e., turbidity and hyperlipemia disappear. From these and other observations, it has been concluded that heparin produces a profound alteration in the lipoprotein pattern. If this lipemia-clearing test were applied to patients with hyperlipemia, it might be possible to detect whether they have a normal response to heparin with liberation of the tissue enzyme which is instrumental in the utilization of neutral fat; or whether they have a disturbance in the release of the clearing enzyme.

As a second study, Block suggested that the level of lipoprotein fractions in the blood of persons in family groups should be determined and the results genetically analyzed. There is some evidence to indicate that a carrier state may exist in hyperlipemic persons which is detected in the alpha lipoprotein fraction. From studies on a large family through several generations, Adlersberg has reported an aberration in the alpha lipoprotein.

Third, Block recommended that detection of the carrier state by biochemical methods be applied to genetically isolated groups. It is here that the procedure has its greatest effectiveness. As an example, he described its application in the study of primary systemic amyloidosis in a genetic isolate. Upon ultracentrifugal analysis of serum lipoprotein from 66 subjects, 29 showed an abnormal pattern in the alpha 2 globulin region, which corresponded approximately to the position of an atypical peak in electrophoretic diagrams. Although biochemical analysis of lipoprotein from individuals with clinical signs was important, if only to establish the clinical significance of the results, its greatest usefulness was in detecting the subclinical, the so-called carrier state. For these reasons, Block recommended studies of the relevant biochemical char-

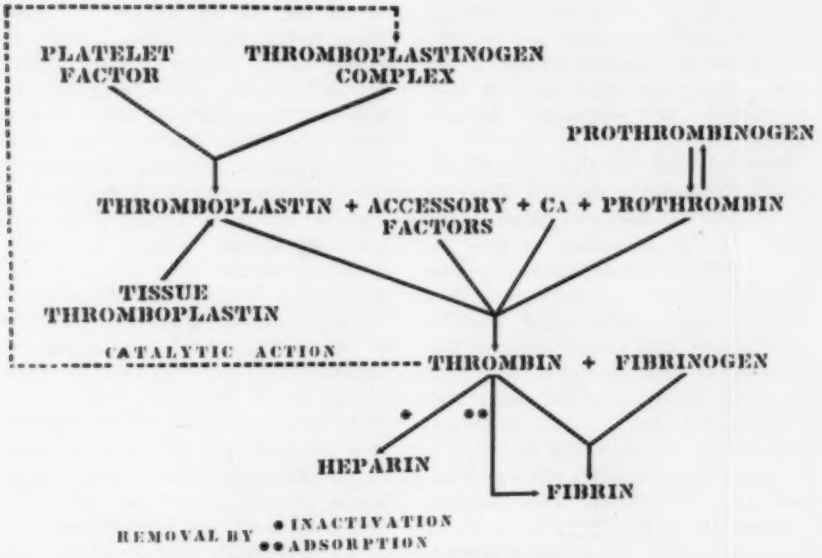


Figure 1—Schema of Blood Coagulation

acteristics of heart disease in genetically isolated groups.

One of the most significant developments in the pathogenesis of coronary disease is the formation of a thrombus which may lead to occlusion. This possibility—an actuality all too frequently—raises several questions: whether the blood of some persons is in a hypercoagulable state; whether that state is measurable; whether it is attributable to an abnormality in the blood; and whether it has a genetic association. In approaching the subject, Dr. Quick presented such evidence as is available. Then, as an aid to understanding both his explanation of his observations and the rationale of his subsequent opinions, he reviewed hemostasis, the process of blood coagulation, and the probable events in the formation of a thrombus.

In an attempt to determine whether a thromboplastic tendency could be demonstrated, Quick conducted a battery of tests on the patient with thrombophlebitis. These tests revealed no real abnormalities that would indicate a thromboplastic tendency. Unfortunately most available tests were not designed to detect coagulability, but the opposite, hemorrhagic tendency. For example, in hemophilia the clotting abnormality can be attributed to the lack of a specific factor, thromboplastinogen (Factor VIII, antihemophilic globulin). But available methods useful in the study of bleeding tendency do not provide such reliable and complete information on hypercoagulability. Because of their limitations when applied to coagulability, the results yielded by these methods are open to question. In Quick's opinion, hypercoagulability is measurable neither by the clotting time nor by any other test routinely used in the laboratory.

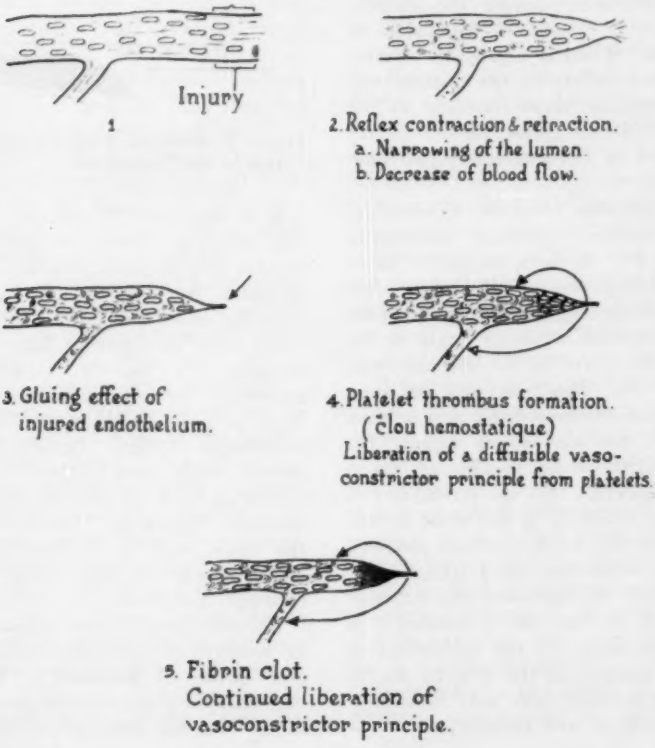
In view of the technical limitations, Quick turned to a different approach. In raising and answering for himself the question, what is hypercoagulability, he reasoned that essentially it must involve a greater amount or an increased rate of formation or reaction of throm-

bin; for after all, it is thrombin that converts fibrinogen into fibrin in the formation of a clot. Avoiding the more difficult and uncertain course of searching for ways to raise the thrombin level by influencing factors that control its formation, he went directly to the experimental production of a clot by injection of thrombin. When thrombin in high concentration was injected rapidly, intravascular clotting throughout the vascular system ensued. But such large amounts of thrombin were necessary that obviously the experimental procedure was not comparable to the natural occurrence of any hypercoagulable state. Then, too, the clotting so far exceeded the extent which might be presumed to occur from a natural hypercoagulable state that it did not represent an analog.

But when thrombin was injected at a slow constant rate, results opposite from what might be expected were obtained. Instead of the clotting time being shortened it was prolonged. One of the reasons for this seemingly paradoxical reaction is that thromboplastinogen drops to a very low concentration. The level of Factor V is also reduced. What is actually produced is a hypocoagulable state which acts as a natural protector mechanism preventing the building up of a hypercoagulable state.

Figure 2

HEMOSTASIS


Injury
1
2. Reflex contraction & retraction.
a. Narrowing of the lumen.
b. Decrease of blood flow.
3. Gluing effect of injured endothelium.
4. Platelet thrombus formation. (clou hemostatique)
Liberation of a diffusible vasoconstrictor principle from platelets.
5. Fibrin clot.
Continued liberation of vasoconstrictor principle.

It should be emphasized that it is thrombin which is the all-important substance in coagulation. There are two ways in which it is formed (Figure 1). In one it is produced in the blood per se, i.e., blood completely isolated from tissue. This process requires a complex reaction: a platelet factor and a plasma factor, the thromboplastinogen complex, form thromboplastin; this then reacts with prothrombin, accessory factors, and calcium to produce thrombin. In a test tube it takes at least from five to eight minutes for that reaction to occur. The slowness of the reaction rate makes it most unlikely that the body develops a hypercoagulable state by this route.

Quite different is the formation of thrombin from another source, tissue thromboplastin, and by another route. Tissue thromboplastin does not have to be manufactured during the clotting reaction. It is widely distributed in the tissue. When it comes into contact with other factors in the clotting system, there is rapid clotting in 12 seconds. It is tissue thromboplastin that could be the source of hypercoagulability.

The first step in arrest of bleeding, i.e., hemostasis, is vascular constriction (Figure 2). It is a factor in intravascular formation of a thrombus. But the thrombus does not form in the blood stream; instead it has its origin at the site of an injury to the vascular wall (Figure 3). This clot gets its start from tissue thromboplastin which leaks out; the thrombus forms rapidly because of the quick action of tissue thromboplastin. Then the thrombus can organize, especially if the blood stream is fast; or the clot may attract platelets, undergo contraction, and extrude serum. The serum contributes to further thrombosis with a new clot. Provided it is not swept away by the circulation, it is superimposed on the original thrombus. As a result there may be successive growth of new thrombi.

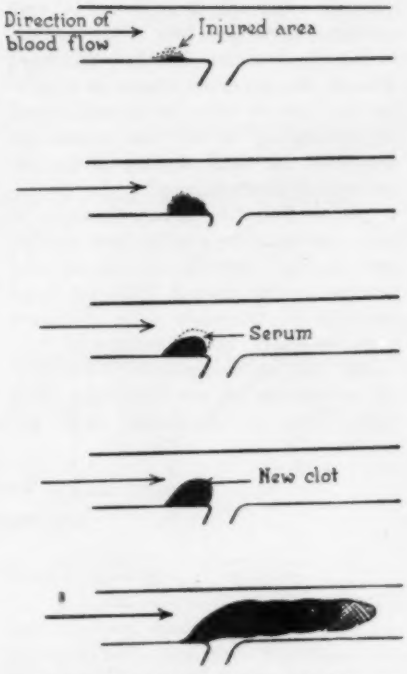


Figure 3—Probable Events in the Formation of the Thrombosis

It is important to reiterate that the clot, which is assumed to play an important role in heart disease, does not originate from the blood itself, but from the vessel wall. It is then coordinated with the clotting factors. Consequently, in Quick's opinion, little knowledge concerning thrombosis is to be gained by study of the blood for coagulation changes. Certainly the reported results from studies on the influence of lipids on clotting are open to question. Since the clot originates in the vessel wall, it is there that the search should be directed in studying coronary thrombosis.

Heredity plays a more important role in hemorrhagic diseases than in any other group of disorders. Perhaps it may also exert an influence over thrombosis. But the chances are rather re-

mote of finding blood changes indicative of a hypercoagulable state that may be relevant to coronary thrombosis and possibly attractive for genetic analysis. Focusing on the vessel wall seems more promising.

Dr. Jarvik discussed the possible relationship of genetic influence to heart disease at various stages in the hypothesized sequence of its production. Conceivably there may be genetic relationships with both the general and specific aspects of the process.

From the studies of Wolff and Hinkle it has been concluded that when persons have illness associated with an adaptive reaction to disturbing situations, they may develop any of a variety of diseases, including cardiovascular diseases. In a sense they may be regarded as being susceptible to many kinds of disease. These persons may have a generalized constitutional weakness. From this conclusion it may be further inferred that all are capable of developing atherosclerosis, provided that they live long enough and are exposed to appropriate environmental influences. In relationship to general constitutional weakness Dr. Jarvik likened atherosclerosis to tuberculosis. With sufficient exposure everyone can contract tuberculosis. Yet there appears to be a genetically determined variation in resistance to this disease, some people succumbing more easily than others. The same relationship might hold for heart disease.

On the other hand, genetics may be more specifically related to the production of heart disease. Not all persons do develop atherosclerosis. Many people die at 80 or 90 with no evidence of it. Only some persons have the capacity. Atherosclerosis can be developed only by those who have the potentiality, presumably on a genetic basis. As in schizophrenia, so in heart disease, only those who have the proper genes contract it.

That both the constitutional and specific processes have a genetic relationship is possible, indeed probable. Conceivably all persons may have a potentiality for developing certain types of cardiovascular disease, whereas only those persons with a specific combination of genes succumb to other types. Perhaps the psychological reaction pattern of certain people is based on a particular combination of genes which may be associated with a type of physiological activity that produces hypertension. It would be important to determine these points because at present there is no genetic evidence for them.

To stress, genetic influence may be related in two ways: (1) Genetic effects may be largely responsible for the situation creating stress; (2) genetic influence may affect the individual's sensitivity and reaction to stress. Situations creating stress may exist in certain families because genetic factors have contributed to the production of other diseases. In families with mentally defective members or schizophrenics, the group is exposed to a greater degree of stress than is usual. It would be informative to determine the incidence of heart disease in families experiencing this additional stress. A study is now being conducted to find out whether the stress created by such a disabling condition as deafness, which is in part genetically determined, increases the incidence of schizophrenia in the family.

In the search to ascertain whether the various pathological changes in heart disease have a genetic relationship, the avoidance of one particular pitfall should be emphasized. Any disorder that is genetically determined has its counterpart on an environmental basis. The environmentally produced disorder, which is called a phenocopy, mimics the genetically determined form so closely that the manifestations of the two types are indistinguishable.

Methodology—In order to answer questions concerning the bearing of

genetic influences on heart disease, both twin and family studies are needed. One of the most important objectives should be to ascertain whether genetics exerts an influence on cardiovascular disease, and if so, whether it would be possible to identify individuals who are particularly vulnerable to the disorder. Then it would be useful to apply studies of twins in a somewhat different way than is usually done. Once vulnerable individuals can be identified, it would be profitable to search in the environment for significant variables that affect them and bring them down with cardiovascular disease. Because it would be reasonably certain that such a group has the potentiality of developing the disease, it would be the only group in which the influences of environmental factors could be so readily studied.

Originally twin studies were designed to reveal the importance of genetic factors by comparing the rates of prevalence of a disease in twins and siblings. Just as valuable, if not more so, would be twin studies in conjunction with experimental exploration of environmental factors. When used in conjunction with the application of therapeutic methods, twin studies could be very useful in investigating physiological and biochemical variables.

In exploring the environment for relevant and significant variables, it is helpful to follow clues. By the same token it is more important to ask the right question than to test a random series of correlations. Studies already under way have indicated a greater correspondence of levels of blood constituents between identical twins than between siblings. On the basis of these observations, it is suggested that when the individuals who are most vulnerable to cardiovascular disease have been identified, it be ascertained whether levels of blood pressure and lipoproteins in the blood are at least in part genetically determined.

A genetic evaluation should be a part of any epidemiological study. A number of simple test factors exist that enable the investigators to detect gross genetic differences within the group or groups being studied.

The application of genetic technics to cardiovascular disease may be divided into three broad areas:

1. Gathering of Information — Complete family history (including infant deaths), an objective description of the subjects' physical characteristics, identification of the subjects with their known relatives, presence or absence of consanguinity, history of exposure to radiation. In countries where registries exist, these should be utilized.

2. Mass Screening Laboratory Technics — Electrophoretic analysis, blood typing, specific antigen-antibody reactions, chromotography, urinary amino acid excretion patterns (urinary tests for alcoptonuria, cystinuria, galactosuria and pentosuria), enzyme determinations, cytological and sex determination. Particularly useful in terms of mass surveys would be the application of carefully designed overload tests to detect the latent state or the carrier state of certain metabolic abnormalities.

3. Studies of special groups, such as genetic isolates and twin-family aggregates.

Lilienfeld has recently published results on a methodological problem in the study of familial aggregation of disease. In particular he investigated the application of a "binomial test" to determine the consistency of observations with a recessive gene hypothesis. His results indicated that this method had a low ability to discriminate between genetic and nongenetic hypotheses. In accord with the published opinions of several geneticists, he drew attention to the difficulties and pitfalls in determining whether a disease is inherited.

EPIDEMIOLOGIC METHODS IN CURRENT CARDIOVASCULAR DISEASE RESEARCH

Ralph S. Paffenbarger, Jr., M.D., F.A.P.H.A., and Dean E. Krueger

DURING the six-month period ending in March, 1959, we have had opportunity to review a series of epidemiologic studies of cardiovascular diseases currently under way across the nation. Twenty-one of these studies deal with some aspect of hypertension or arteriosclerotic heart disease, and thus their study methods may be of interest to the members of this conference. An over-all view of these study methods is given, as well as brief descriptions of each of the 21 studies. Abstracts of eight, which perhaps have been less widely discussed than the well known endeavors at Framingham, Albany, etc., exemplify the range of methods employed and are incorporated in the body of this report. Abstracts of the remaining 13 are included as an addendum.

Study Methods

The application of epidemiologic methods to the study of arteriosclerotic heart disease (ASHD) and hypertensive heart disease (HHD) is taking three approaches: descriptive, analytical, and experimental. (1) In the descriptive approach, observations on recognized disease are made in terms of chronologic and geographic distributions and the characteristics of patients. Personal attributes of patients are contrasted with similar attributes determined from census figures, or some other available source, for residents in the patients' community. (2) In the analytical approach, independent variables are identified and related to the occurrence of disease. The frequency of specific host or environmental factors and the frequency of disease are each determined. Populations being studied are divided into those with and those without disease, and in each group the proportion with common personal attributes is ascertained. Also, the proportions of diseased and of nondiseased populations that engage in a common practice, encounter similar incidents, or are exposed to similar potential risks are measured. (3) In the experimental approach human volunteers are induced to change their habits, or environmental factors are altered, and the effect of these changes on disease is measured.

Regardless of the approach used, the purpose is to determine whether individuals characterized in one way, such as by a physiological or socioenvironmental factor, are differentiated in a second way, as by a disease. For example, one might determine whether a difference in the frequency of coronary heart disease (CHD) exists between a group with premature presbyopia and another group without it. The essence of the approach is comparison, and it is encouraging that investigators are greatly concerned with standardizing their observations and accurately classifying persons by the presence or absence of two variables, the factor in question and the disease, in order to make valid comparison possible. The scientific requirement of assessing the socioenvironmental variable independent of the clinico-laboratory variable is being met. For the most part, attention is given to other influencing variables through selection

of study subjects or through adjustment by accepted statistical technics. Uncertainties in diagnosis of disease lead to use of "probable" or "borderline" classifications, and most socioenvironmental factors are measured on a gradient scale. Thus, comparison of the disease variable and the socioenvironmental variable usually is not limited to a two by two correlation.

The search for association between either ASHD or HHD and any of a number of host or environmental factors uses one of three methods. First, contemporary studies of diseased and disease-free persons are providing "snapshots" or prevalence figures of the specific factors under study. Second, studies that are longitudinal in time are picturing "flashbacks" to an earlier period by measuring (through interviews, past medical records, and similar data) the proportions in the disease group and in the disease-free group that have experienced the same specific factors. Last, longitudinal studies are following individuals through a period of time in "motion picture" fashion, and by means of appropriate clinico-laboratory tests are making initial and successive determinations of the frequencies and magnitudes of the diseases and the factors.

Populations being studied include (a) hospital or clinic patients, (b) closed populations in institutions, and (c) groups of persons in communities-at-large. These populations ordinarily are chosen to meet a specific requirement of the study design.

The abstracts of study methods reviewed here are necessarily brief. Responsibility for omissions, inconsistencies, or inaccuracies in these abstracts is ours and not that of the investigators who supplied the information.

Current Studies

1. Navajo on Reservation—The first study to be described is being conducted out of the Western Navajo Hospital in Tuba City, Ariz. The frequencies and distributions of cardiovascular diseases (CVD), particularly coronary heart disease (CHD), among the Navajo are being observed. Specific aims are to determine (a) the prevalence and incidence of CHD, (b) the serum lipid patterns of adult Navajo males, (c) the make-up of the Navajo dietary, and (d) the geographic and demographic characteristics of Navajo subgroups on the reservation. These endeavors were prompted by prevailing clinical impressions and published reports to the effect that the Navajo experience less CHD than the white or Negro races. The design of methods includes the examination of 150 adult Navajo males who were considered healthy and without clinical or laboratory evidence of diabetes, renal disease, or thyroid disease. Clinico-laboratory examinations of snapshot type are being performed, and for comparative purposes, similar measurements are being made on a selected series of healthy white males seeking routine medical checkups in a medical clinic in Albuquerque. In addition, the heart and aortas of Navajo and clinic patients coming to necropsy are being examined for atherosclerosis. (Approximately 50 per cent of the Indians who die in the Fort Defiance Navajo Medical Center or in the Western Navajo Hospital come to necropsy.)

2. An example of the motion picture method applied to an open population is the study in Evans County, Ga. The study has been activated in search of precursive factors of atherosclerosis and its sequelae. The total county census (by age, sex, race, address, and place of birth) has been determined from vital records, lists of utility subscribers, newspaper solicitations, and house-to-house canvasses. The census is being kept current by periodic rechecks using these same counting devices. Morbidity

and mortality data are obtained through physicians, vital records, and hospital data. The county, with a population of 7,500 and a two-to-one white-to-Negro distribution, is largely rural and is served by two practicing physicians. One of the physicians is the sponsor and principal investigator in this study and the other cooperates closely. Marked rapport exists among the physicians and their patients who comprise essentially the total county population. Necropsies are requested on the death of each county resident and are performed by a consulting pathologist on approximately 50 per cent of decedents.

Relative rates of CHD by race and sex groups are being determined longitudinally from (a) physician, hospital, autopsy, and vital records; and (b) successive censuses of Evans County. This phase of study will continue through calendar year 1960.

Blood specimens for serum lipid determinations are being drawn from approximately 1,200 adults listed on the Evans County census registry. Subjects are chosen through use of a stratified sampling technic. Laboratory testing of specimens permits comparison of lipid levels by age, race, sex, and season of the year in which the samples were collected.

For one physician's office practice, all patients aged 35 years and over who seek medical advice or treatment for any illness are being followed over a five-year period (mid-1958 through mid-1963) for the occurrence of CHD. To the degree that a busy practice permits, the following data are being recorded on each patient at least once annually: (a) family and personal history of heart disease; (b) results of a general physical examination; and (c) findings from serum cholesterol and alpha and beta lipoprotein tests. When patients do not return within a year they will be contacted and lipid determinations repeated as a minimum examination. All overt attacks of CHD and deaths from this cause will be recorded as they are recognized. Biennially the health status of each participant will be reviewed through telephone or personal contact. Through records of such repetitive observations and laboratory determinations, it is expected that some of the precursors of CHD may come to light.

The influence of sex, race, and stress factors (physical and psychological) on serum lipid levels of children from birth through preschool ages is being determined. Umbilical cord blood samples are being collected at most deliveries in the county, and repeat blood samples are drawn at six-month intervals. These specimens are being tested for levels of cholesterol, alpha and beta lipoproteins, and the "lipid mobilizing factor." The race, sex, and birth weight of each infant are recorded, together with weight and illness histories at each six-month interval.

Studies of school-aged cohorts are patterned after the newborn studies, with effort being made to enlist all school children in the county. More than 95 per cent have received parental approval to participate and are being entered in the study as rapidly as laboratory facilities permit. Repeat blood samples are being drawn at annual intervals and special interest centers on the influence of puberty on serum lipid levels.

3. The snapshot method is being used at Louisiana State University School of Medicine in study of atherosclerosis. Procedures have been standardized for staining arteries with Sudan IV and for preserving them in flat, transparent, durable, plastic bags. Also, a method of grading human aortas, by which different pathologists secure similar results, has been developed and used to estimate macroscopically the extent of fatty streaks, fibrous plaques, and complicating lesions (hemorrhage, ulceration,

thrombosis, and calcification). Current studies seek information on pathogenic mechanisms through description of aortas and other arteries from necropsies on individuals aged one year and over. Specimens are received from general hospitals and medico-legal services in New Orleans, Guatemala, Puerto Rico, and Colombia. Special attempts are made in these geographic areas to necropsy all deaths regardless of cause. All aortas, most coronary arteries, and, more recently, cerebral arteries are graded as to intimal lesions. Physical studies (photographic, light refraction, and colorimetric) and chemical studies (quantitative and qualitative determinations of lipid) are in progress on a sample of specimens to (a) develop a grading scheme that does not require personal judgment and (b) search for age, sex, and racial differences in pathologic lesions. An endocrine project, including urine assays, is being developed to permit correlation studies with atherosclerotic lesions.

As a second study, observations on zoo-reared baboons have suggested that this widely prevalent ape, which is first order below the anthropoids, might lend itself as an ideal experimental animal for atherogenic studies. Hence, an African expedition was undertaken in the summer of 1958 to obtain baboons from their native habitat. A total of 163 animals was captured and sacrificed for pathologic examination. Specimens permitting estimation of chronological age and degree of atherosclerosis were shipped to New Orleans for study. (Age estimates are being made from skull, teeth, and bone specimens together with measurements of body weight and size.)

4. Out of the Georgia State Health Department a motion picture study of two circumscribed populations is in progress. Since October, 1957, serial observations have been made on residents of two monasteries in study of dietary regimens as they may relate to arteriosclerotic heart disease (ASHD). One monastery quarters members of the Trappist order, whose religious dictates require a meat-free lactovegetarian diet. The second monastic population comprises Benedictine monks who are omnivorous and consume a diet essentially comparable to that of citizens-at-large in the United States. Quantitative and qualitative dietary records are collected on selected fast, feast, and regular days in order to compute average intakes per monk per day. Yearly clinico-laboratory examinations and medical records during any period of hospitalization permit evaluations of illnesses including ASHD. Blood specimens drawn quarterly are subjected to a battery of tests for lipid and protein determinations. Participation in this ongoing study is voluntary, with more than 95 per cent of the Trappist community and a comparable percentage of residence-stable Benedictines enrolled.

Eighty-two Trappists, ranging in age from 20 to 80 years (median age=35 years) are participating. These monks live rigorous lives in primitive physical settings without modern conveniences. Their work is largely of heavy manual types, which is interspersed with sedentary hours for meditation. There is essentially no verbal communication among the monks. On days selected for determination of diet intake, each monk keeps a record of his consumption by noting during meals the amounts and types of food ingested. Uniform servings and the use of standard spoon sizes facilitate accurate reporting. Tobacco and alcohol are not used by these monks.

Sixty-five Benedictine monks of an older age range (median age=40 years) than their Trappist peers, are participating. They live in modern dormitory type structures, engage in relatively less physical exercise, and are largely a teaching order. Their diet permits little freedom of choice qualitatively, but

contrary to that of the Trappists, allows for more quantitative selection. A food model demonstration is presented at the monastery to assist the monks in making quantitative estimates of their intake. A small proportion of members of this order uses tobacco and a somewhat larger proportion uses alcohol.

5. A combination of snapshot, flashback, and progressive motion picture methods is in use at Beth-El Hospital, Brooklyn, N. Y. In progress over the past two years, this study is designed to determine whether specific somatotypes are associated with a coronary diathesis and, if so, for what reason. Members of a fraternal organization are invited to a cancer and heart disease detection clinic for specific clinico-laboratory tests that permit classification by body type, coronary heart disease status, socioeconomic stratum, and cholesterolemia and estrogenuria levels. The base population from which subjects volunteer to participate consists of 35,000 residence-stable Brooklyn males who carry health insurance. Participants are somewhat health-conscious adults who largely lead a sedentary life and eat high fat diets. Sixty per cent are salesmen and 95 per cent are married. They are queried as to dietary and social habits and classified into types of body builds by the same examiner. A second examiner evaluates their cardiac status through administration of a medical history, physical examination, and electrocardiogram (ECG) tracings. Their attack rates of CHD are being assessed through (a) annual reexaminations, and (b) reports on cardiac morbidity and mortality from their health insurance plan, which includes physician and hospital coverage. One hundred selected subjects in each of the three basic somatotypes (ectomorphs, mesomorphs, and endomorphs) are being examined for estrogen levels by analysis of 24-hour urine samples.

As an independent study the degree of coronary atherosclerosis and the type of body build are being assessed for all individuals dying suddenly and coming to medical examiner's autopsy in Westchester County, N. Y. The collection represents a 10-year experience and comprises largely deaths from automobile accidents.

6. Sometimes referred to as a human population laboratory, studies in progress at the University of Michigan School of Public Health maintain a current inventory of people, places, and things. Over an 18-month period nearly all residents of Tecumseh, Mich., and adjacent residential areas have been characterized by demographic and other factors. The prevalence of 41 chronic disease conditions has been determined for this group through self-administered questionnaire forms. The total population of approximately 8,300 persons has been identified by household (N=2,400), familial, and kindred (N=3,400) aggregations. An additional 1,000 persons from neighboring communities who are relevant to the bloodline aggregates have been identified.

Through seven consecutive monthly reports received by mail from each household, new occurrences of illness have been determined. Also, study has been made of the physical facilities and of the receptiveness of lay and medical groups to future more intensive studies in this population. The collected data have been analyzed as a lead-seeking device, and to determine the suitability of the population for subsequent epidemiologic study of a variety of chronic disease entities. On the basis of these analyses, the investigators are satisfied that the community lends itself to productive future study since (a) the single large industry in Tecumseh is relatively stable and the population is "nonmigrating"; (b) adequate numbers of individuals over the entire age spectrum are available; (c) a high prevalence of numer-

ous chronic diseases exists; and (d) new cases of CVD occur with a frequency which permits testing of many hypotheses over a several-year period.

Early identification of individuals as to their susceptible or immune status in reference to heart diseases through both snapshot and motion picture studies is under way. (Other chronic diseases will be studied in similar fashion.) Specific aims include (a) identification of individuals with heart disease and associated conditions; (b) search for associations between factors of host-environment and specific types of heart disease; (c) analysis of data by kindreds in search of familial influences and genetic patterns; (d) description of the frequencies and distributions of cerebrovascular accidents (CVA) and determination of their relationship to heart disease; (e) examination of heart disease patterns for relationships among congenital, rheumatic, arteriosclerotic, and hypertensive heart disease; and (f) initiation of similar studies of chronic diseases other than heart disease. Procedures entail the examination of Tecumseh inhabitants, residents of surrounding areas, and kindreds in neighboring communities (N=approximately 9,500). Methods include taking detailed medical histories by trained lay interviewers, review of these histories by physicians who perform physical examinations, and laboratory examinations.

As another study, blood pressure levels among Bahama Negroes have been measured to determine prevalence ratios of hypertension and to compare the findings with similar data available for Negroes living in the United States. One study is based on the clinical records of the single physician on the Grand Bahama Island and pertains to approximately 60 per cent of the inhabitants.

A third study relates to blood pressure determinations made by an epidemiologist and medical students from the University of Michigan on 3,000 individuals chosen as a probability sample of Nassau City on Providence Island. Demographic, social, and cultural data have been collected on these subjects, a large proportion of whom are Negroes. Drinking water samples from selected communities have been collected for sodium determinations since the water frequently is brackish, and association between water of high sodium content and hypertension will be looked for.

7. At the Johns Hopkins University School of Medicine and School of Hygiene and Public Health two different methods of study and two different types of population are being used in search of factors associated with CVD. Since 1946 medical students at the Johns Hopkins University have been used as subjects in a study designed to identify those characteristics which may be of value in predicting and in preventing an early onset of CVD. To date nearly 1,000 students have been classified by a variety of genetic, physiological, psychological, and metabolic characteristics in search of those traits which are associated with CHD or HHD. The CVD "heritage" of each student is assessed through family histories taken on parents, grandparents, uncles, and aunts by the students themselves in their third and fourth years at Hopkins. On the fifth and tenth anniversaries of graduation each student is reevaluated by mail questionnaires concerning his health status and sociophysical habits. The health status of his parents also is redetermined. Under the assumption that students experience greater risk of developing CVD if they have an unfavorable CVD "heritage," constitutional differences between low and high risk student groups have been identified. Based on observations to date, a four-way grouping of healthy students according to parental history and student characteristics has been proposed as a basis for selecting highly

susceptible individuals. The individual "positive traits" in this grouping include (a) higher serum cholesterol levels, (b) nonectomorphic body build, (c) higher blood pressure levels, (d) tachycardia, and (e) blood pressure hyperreactivity to cold or exercise. A student with two or more such "positive traits" is classified as having "positive individual characteristics." The parental "positive traits" signify that one or both parents has a history of coronary or hypertensive disease. Follow-up data on health will be related to these characteristics.

As an independent study, the death certificates of Baltimore residents, aged 45 years and less, who died between 1954 and 1959 have been categorized by cause of death in search of factors predisposing to ASHD. Subjects with death ascribed to ASHD have been subclassified into one of three categories following validation of death certification through review of hospital, physician, and autopsy records. These categories are: (1) definite ASHD, (2) uncertain ASHD, and (3) definitely not ASHD. In the period under study, death certificates with diagnoses of ASHD included nearly 200 subjects with a "validated" diagnosis of ASHD (Group 1), 250 with uncertain ASHD (Group 2), and approximately 100 with diseases other than ASHD (Group 3). All other Baltimore decedents in this age class (45 years and less), except those dying of accidental causes, are classified into a fourth category (Group 4). Individuals whose death was ascribed to ASHD (Groups 1, 2, and 3) are then matched by age, sex, race, and date of death on a one-to-one basis with individuals classified as having died from other than ASHD (Group 4). Survivors (spouses or siblings) of the deceased are interviewed by nurses making home surveys for specific and detailed information on family history of ASHD; alcohol and smoking; other diseases; marriage and reproduction; and psychic and physical stress. Through cross-correlation analyses those factors of host which are associated with early death from ASHD are being sought. In search of precursors of ASHD, serum cholesterol and serum uric acid determinations are being made on a sample of the decedents' children and spouses in each of the four groups.

8. Two studies are being conducted by workers affiliated with the Health Insurance Plan of Greater New York and Columbia University College of Physicians and Surgeons. The first is aimed at determining the influence of female gonadal function on the development of CHD. The method employs the measurement and comparison of CHD prevalence in oophorectomized and in a control group of non-oophorectomized, hysterectomized women. White female gynecological ward patients aged 45-65 years from the Columbia Presbyterian and Mt. Sinai Hospitals are being included in the study. Other hospitals will be added if necessary to realize the population of 700 oophorectomized and 1,300 non-oophorectomized subjects estimated to be needed in order to determine whether there is a difference in CHD prevalence. Test and control groups are being matched by (a) period of operation, within three-year groupings, (b) age at operation, and (c) nationality or country of origin. Patients with hypertension or diabetes at time of operation are eliminated from the study. Study subjects are identified through medical record review and then contacted through one or another of the following methods: (a) telephone, (b) attending gynecologist, (c) social service exchange, (d) return United States mail (Form 3547), (e) Welfare Department, or (f) visits by a retail credit agency. When notified of a death, the investigators obtain a copy of the death certificate. Survivors are invited to the hospital for medical

and laboratory examinations. A history of estrogen administration is obtained from the patient's family physician. The criteria for diagnosis of CHD rest largely on history of episodes and current ECG tracings. The study will continue until interpretable results are obtained.

The second study is that of CHD survivorship and repeat attacks. It has been activated only as a pilot undertaking thus far, utilizing new cases reported from three HIP Medical Groups. Patients are invited for examination by a single physician and for appropriate laboratory examinations. Serial medical checks are planned at six-month intervals for two years, and biennially thereafter. Attention will be given to clinical manifestations that develop as well as to mortality.

Discussion

In general, the studies reviewed here employ methods which have been developed and extensively applied in the study of infectious diseases. The process is that of measuring and comparing the frequencies and distributions of disease within defined populations. The aim is to identify or unmask those factors and conditions that cause disease. In regard to causation, it is recognized that the inability to see the dynamic processes of pathogenesis in human subjects calls for use of the epidemiologic method and the inductive reasoning on which it depends.

Of the three methods being used in search of associations between cardiovascular disease and host or environmental factors—termed "snapshot," "flashback," and "motion picture" for convenience of description—it is generally agreed that motion picture studies provide the most comprehensive and accurate data. The three study types are complementary, however, and are most effective when they are used in combination.

The investigators interviewed are aware that the mere demonstration of statistical association between a given factor and a given disease does not establish the link of causation between the two events. Rather, such an association simply indicates that a change in the frequency or magnitude of one event is accompanied by a change in the frequency or magnitude of the other. A given event shown to be directly associated with a given disease may represent only an index of a second event which is in fact a true cause.

Procedures to distinguish temporal association from causal relationship must be designed to fit specific situations and conditions. Such differentiation requires a thorough knowledge of biologic concepts of the disease, together with the conduct of studies that would test specific hypotheses. Procedures would seek to verify by further facts, to establish ancillary evidence, to reproduce results under different circumstances, or to develop alternative hypotheses.

Uncertainty exists as to whether the factors presumed to be related to CVD represent primary or secondary etiologies—that is, are they definitive causes, or in contrast, do they provoke clinical attacks in individuals harboring a primary cause? Do such factors as hypercholesterolemia, hypertension, obesity, and the like, comprise definitive or only predisposing etiologies of CHD? These questions, thus far unanswered, may prove analogous to the interactions between primary and secondary etiologies in acute poliomyelitis. In this disease three immunologically distinct viruses comprise essential causes, and such factors as pregnancy, oropharyngeal surgery, and the intramuscular inoculation of antigens have been established as contributing causes.

Current and Proposed Study Factors

The 21 studies which we have reviewed are measuring a variety of environmental and physiological characteristics, in addition to those on which information is obtained in the course of a routine diagnostic examination—medical history, social history, physical examination, and laboratory tests. Table 1 shows a partial list of these additional factors, the number of investigators currently measuring each factor, and the number of other investigators among the 21 principal investigators who were proposing, but had not yet begun to measure the respective factors at the time of our review in early 1959.

Decision to measure a particular factor implies that some hypothesis about that factor and the occurrence of disease is being tested. For any given factor, different measurements are being made from study to study.

Diet is the factor of interest to the largest number of investigators; ten are currently measuring diet and seven others propose to do so. Four are now using some measure of psychic stress, and five others plan to measure it.

The items "physical stress" and "occupation" require some explanation. Physical stress refers to the administration of some test of reaction to exertion, such as an ECG after exercise, whereas occupation refers to a job classification as an index of physical activity.

"Environment change" as used here means an attempt to alter a specific characteristic, e.g., dietary intake, and to measure the effect of this change on the occurrence of disease. A decision to undertake environmental change rests not only on confidence that an association exists between an environmental characteristic and occurrence of disease, but also on the idea that a change in the environment will be accompanied by a change in the occurrence of disease. The problems of measurement of the factor still exist, and may be made more difficult because of the fact that the investigator has induced an ecologic change.

It is apparent from this list of factors being measured in current and proposed research that the subject areas of measurement selected for attention in this Conference on Methodology are of immediate and major importance in epidemiologic studies of CVD.

Table 1—Environmental and Physiological Factors Measured in 21 Selected Population Studies

Factors Measured	Population Studies	
	Current	Proposed
Psychic stress	4	5
Physical stress	3	2
Dietary	10	7
Occupation	8	0
Environment change	1	2
Lung function	3	0
Skin fold	5	0
Clotting	2	2
"Endocrine"	5	1

Summary

The methodologies being employed in a series of epidemiologic studies have been reviewed. By means of measurement and comparison, the aims of these studies are to determine whether persons manifesting specific physiological or socioenvironmental factors experience a different risk of cardiovascular disease than do persons without such factors. Associations are sought between a specific disease and a specific factor through (a) contemporary studies providing a snapshot of the two events, (b) chronological studies picturing flashbacks to an earlier period, and (c) long-term studies of progressive motion picture type. Groups under study include closed or open populations that are chosen at random or selected on the basis of some preexisting condition.

It is recognized that the success of both current and proposed epidemiologic studies will rest on standardized observations and on precise classifications of persons according to the presence or absence of two variables, a specific factor and a specific disease. Follow-up studies will attempt to distinguish between associations that are only statistical and those that reflect a causative relationship. To this end, epidemiologic studies will complement clinico-laboratory efforts by providing collateral evidence; by verifying, amplifying, or modifying prevailing concepts; or by developing alternative hypotheses. It is anticipated that application of epidemiologic methods to the study of chronic diseases will lead to evidence consistent with a causative hypothesis, as have such methods in the study of acute diseases.

Addendum

9. Framingham, Mass.—This longitudinal study began during the period of 1948 to 1950 and has run continuously to date. Serial observations have been made on over 4,000 individuals, or 69 per cent, of an initial randomly chosen sample that represented two-thirds of the Framingham population, aged 30 to 62 years. Biennial medical histories, physical examinations, and laboratory tests have provided the data for study. Reports from local practicing physicians and hospitals have complemented these records. The study's initial aims were to obtain descriptive information on CVD and to measure prevalence and incidence of these diseases in the population. Secondary purposes were to test selected hypotheses concerning causation of heart disease, these hypotheses being constructed from clinical impressions or the epidemiologic findings of others. To date, major effort has been directed to ASHD and HHD and to associations between these diseases and specific factors of host. Foremost among these factors have been hypercholesterolemia, hypertension, and obesity. More recently other factors have been added and include dietary habits, alcohol consumption, tobacco usage, educational levels, lipoprotein measurements, and district of residence in Framingham. Plans call for extension of the study over at least ten more years.

10. Connecticut State Health Department—Studies began early in 1957 with the initial aims of (a) measuring the prevalence and incidence of CHD and CVA in Middlesex County, and (b) testing specific hypotheses concerning causation of myocardial infarction (MI) as related to particular dietary habits and to social and personality correlates of stress. Case finding has been achieved through reports from practicing physicians and hospitals, coupled with death certifications. A 10 per cent probability sample of the population was queried through Bureau of Census interviews to provide population estimates for rate denominators, an independent estimate of clinically manifest CHD, and control series for the comparison phases of the study, i.e., the nutritional and sociopsychological phases.

The sociopsychological aspects of the study contrasted a sample of white male patients, aged 35-64 years, who survived an attack of MI, with an equal number of patients suffering from an acute severe illness other than heart disease and matched with the test group by: (a) age to within five years, (b) race and sex, (c) occupational level, and (d) ethnic origin traditionally similar to that of the test subject. These studies continue and are currently directed at refinement of both hypotheses and tools of measurement.

11. New York State Department of Health—A long-term project began in 1953 as repetitive observations on nearly 2,000 male Civil Service employees, aged 39-55 years, from the Albany

area. Participants represented 89 per cent of the population invited into the study. Primary objectives have been (a) to evaluate established methods of early detection of all forms of heart disease, (b) to evaluate new technics for this purpose, and (c) to look for etiologic factors of CHD. Annual physical examinations and medical histories by physicians, as well as self-administered questionnaires, have provided the data for study. Clinico-laboratory measurements have permitted a wide search for factors associated with all types of CVD. Special emphasis has been placed on the study of potential nutritional influences on these diseases. The study proceeds in standardized fashion with more intensive clinical observations being made on subsamples of the study population.

A second project began in early 1955 and continues to date. It comprises a study of consecutive autopsies from a general hospital, and the comparison of cardiac pathology with ante-mortem characteristics and environmental exposures of the decedents. The principal purpose is to search for etiologic factors of coronary occlusion and MI. Observations at necropsy include measurements of the lumens and thicknesses of coronary vessels. Observations concerning the autopsied subjects are made through medical student interviews with a close relative of the decedent. Other social and environmental details are obtained from the usual family physician and life insurance medical records of the deceased. Selected characteristics being studied include nutritional factors, usual occupation, weight, alcohol consumption, tobacco usage, and so forth. Comparisons on these characteristics are made between individuals dying of heart disease and individuals dying of other diseases. It is expected that the study will be extended beyond the current population of approximately 900 autopsies.

A third study is being started which contrasts, by retrospective means, cases of MI with matched control subjects. The case population is being obtained by a carefully developed and vigorously monitored reporting system from all physicians in Albany County. Reporting includes cases with other manifestations of CHD, but detailed study is being limited to survivors of first infarctions. "Control subjects" matched on five characteristics (age, sex, race, socioeconomic status, and urban-rural residence) are drawn from a 5 per cent census of the population. It is estimated that 500 cases, matched with an equal number of controls, will be collected by 1961. Comparison of these populations will be directed primarily toward the variables of diet, physical activity, and chronic emotional stress, although a number of other characteristics are being studied.

12. Columbia University College of Physicians and Surgeons, Harvard Medical School, and University of British Columbia Medical School—For the past 12 years a group of 100 sympathectomized (Smithwick operation) hypertensives and an equal number of untreated hypertensives have been followed to assess the effect of this operation on survival. Pairs of test and control subjects were selected from hypertensive clinics in New York City, Boston, and Vancouver. They were matched by (a) age, race, and sex; (b) average and range of blood pressure readings; (c) cerebral symptoms and complications; (d) cardiac size and ECG patterns; (e) histories of angina or cardiac failure; and (f) other factors including degrees of proteinuria, eye ground changes, and renal damage. Each of three investigators reviewed clinical and survival data on all pairs in a "blind fashion" at two, five, and ten years after subjects were entered into the study.

Independent studies of similar

matched-control type are being undertaken at Columbia, using groups consisting of 25 patients each, to test specific hypotheses. These groups will provide information on relative survival rates of (a) patients with malignant and essential hypertension, and (b) drug-treated and untreated hypertensives.

13. New York City Health Department—This project began in February, 1957, to determine (a) if it were feasible to achieve dietary control in a free-living population, and (b) if such dietary management would reduce total cholesterolemia and lower coronary heart morbidity and mortality. Male volunteers willing to follow tailor-made dietary patterns were solicited through two newspaper announcements. They were included in the study, after attending an orientation lecture, if they expressed willingness to follow a prescribed ("prudent") diet over many years, perhaps until age 65 years. Originally the study included males aged 50-59 years, but this has since been broadened to include age classes from 20 through 59 years.

When a subject enters the study, a medico-laboratory examination is conducted and a comprehensive diet history covering the two preceding weeks is obtained by personal interview with the subject and his wife. The interview permits an estimate of all nutrients as well as the intake of total calories and calories from fat. If the subject is judged by clinical means to be overweight, he is put on a weight-reducing diet. When a "normal" weight is achieved, the subject is placed on a prudent diet that includes a fat intake providing about 30 per cent of total calories. Fats are divided half and half into saturated and unsaturated types of fat. (Part of the latter is given in such forms as specially prepared margarine containing 80 per cent unaltered corn oil, and a "milk" constructed from a homogenized mixture of fat-free powdered milk, vegetable fat, and water.)

Serum cholesterol levels are measured at weekly intervals at the outset to establish a base line which is computed as an average of two or more determinations within 10 per cent of the lowest. Follow-through is attained by (a) annual medical examinations with ECG tracings; (b) serum cholesterol measurements and diet and weight checks every four weeks; and (c) sessions with a board of review (physicians) every ten weeks to discuss the individual's progress. Subjects provide medical data at the ten-week check; and hospital information, where it exists, complements this. Subjects are told that they will be followed personally until age 65 years, and thereafter through Social Security records.

14. University of Pittsburgh Graduate School of Public Health—The mortality experience in (1) the Arsenal Health District of Pittsburgh during the interval 1951-1956, and (2) Donora, Pa., from 1948 to 1957 has been reviewed. Mortality has been examined in relationship to prior findings of morbidity surveys in each area. (The Donora survey of 1948 investigated the health effects of smog exposures in October of that year. The Arsenal survey was undertaken to measure the frequency of chronic illnesses and medical care in 1951.) Together with these mortality studies, the surveys of these populations have permitted prevalence estimates of various chronic conditions including heart diseases. Findings have convinced the workers of a need for (a) more detailed observations on recognized cases of all diseases, and (b) a better understanding of the timing of onset of overt heart disease and its progression. Forthcoming studies in a group of industrial employees will give attention to these problems.

15. Presbyterian-St. Luke's Hospital

—A five-year study of heart diseases among a large group of industrial employees began in the fall of 1957, with particular emphasis on CHD. Study subjects were men aged 40-55 years who had been employed two years or more in a Chicago electronic industry and who, on review of the company medical records, were believed not to have had either MI or angina pectoris when the study started. A total of over 3,000 men was randomly chosen from the complete roster of company employees and invited to participate. Over 2,100 (70 per cent) complied, have been examined, and are now in the second round of examinations. The aims are (1) to determine the cardiovascular status of subjects at the time of the initial examination, (2) to measure incidence of heart disease through four annual reexaminations, and (3) to relate the incidence of heart disease to various physiological measurements and other characteristics of the subjects. Data gathered at the initial examination included (a) a family history prepared by the subject; (b) a medical history and physical examination by one of 25 volunter physicians assisting in the study; (c) clinico-laboratory tests including somato-typing with photography; (d) diet assessment by detailed interview with the subject and a questionnaire completed by the spouse; (e) physical activity measurement by analysis of job requirements and an interview concerning off-the-job physical exertion; and (f) personality traits determination as revealed by the Minnesota Multiphasic Personality Inventory. These procedures are being conducted in facilities at the plant and require about two half-days for which the subject is given time off with pay.

16. Tulane University—Since 1941 the influence of hot and humid (subtropical) environments on physiologic and pathologic responses in man has been under study. Observations are being made both in hospital wards and in experimental chambers using normal subjects and patients with chronic congestive heart disease. Measurements of cardiac function are being contrasted between study populations, and temporal comparisons are being made within these populations.

17. South Carolina College of Medicine—Clinico-laboratory procedures have been developed and standardized to permit screening of large numbers of subjects for (a) blood lipid levels, (b) whole blood coagulation, and (c) intravascular agglutination of erythrocytes (sludging). Interrelationships among these variables are being sought for several contrasting groups including (a) selected diseased and normal populations, and (b) samples of white and Negro residents of metropolitan Charleston. A battery of lipid tests are being run on all blood serums, including those for cholesterol, phospholipid, triglycerides, and alpha and beta lipoproteins. Microscopic observations, photographs, and closed circuit televising of the capillary circulation in the bulbar conjunctiva allow estimation of the degree of erythrocyte agglutination and arteriolar plugging with sludged masses. Blood coagulation is measured by conventional technics.

18. California State Department of Health—In 1948 a total of 577 "healthy" individuals aged 50 years or more were selected from 843 registrants who volunteered to participate in a study of nutrition as related to aging. Selection from the registrants strove to include only individuals who were physically and mentally capable of participating, in good health, not under a physician's care within the three prior months, and not food faddists. Selection attempted to achieve an equal sex distribution and a range of age and economic classes. Initial study of this group included (a) a nutritional history and a record of seven-day food

intake; (b) a detailed medical history and complete physical examination; and (c) a series of laboratory results from blood and urine analyses, and from chest x-rays, bone density determinations, and vaginal (Papanicolaou) smears. Follow-up physical examinations and dietary evaluations of as many subjects as were available were made in 1952 and again in 1954. Data that have been analyzed pertain to mortality, morbidity, and disability (both for CVD and for total disease) in relation to the original (1948) physical findings, blood analyses, and diet patterns. The health status of subjects still available for examination and interview is being reevaluated after a total of 11 years of observation.

In 1951 a multiphasic screening examination was given to 4,000 longshoremen who volunteered to participate, out of a total of 6,000 such workers in the San Francisco Bay area. Tests included measurements of age, height, weight, hearing, blood pressure, hemoglobin, blood sugar, glycosuria, albuminuria, a chest x-ray, and an ECG tracing. The subsequent mortality of the 4,000 volunteers and the 2,000 nonparticipants has been followed through death certificate analyses and union health insurance records. This study continues as a routine operation, offering a potential for testing a series of hypotheses of causation.

A health survey of a representative sample of Californians was conducted in 1954-1955 whereby information was obtained for nearly 32,000 individuals by Bureau of the Census interviewers. A total of 250 individuals (150 males and 100 females) gave history of some form of CHD. A substantial proportion of these individuals was matched with disease-free control subjects of the same age and sex, chosen from the survey population. Interviews were held with diseased and control subjects to determine the relative frequencies of various characteristics that might be related to CHD. (Next of kin were interviewed where subjects in the sample had died.) Special attention was given to (a) smoking habits, (b) presbyopia, (c) physical exertion at work, (d) participation in athletic events, (e) occupation, (f) urban versus rural residence, and (g) native versus foreign birth.

19. Mt. Zion Hospital, San Francisco, Calif.—The role of specific behavior patterns as they may predispose to CHD among selected population groups is under study. In general, these efforts measure independently (a) personality and behavioral patterns and (b) historical experiences with CHD. Subjects, many of whom are industrial executives, were selected if they gave evidence of highly developed aggressiveness, competitiveness, and a tendency to accelerate all activities; or if, on the other hand, they seemed to lack these attributes. Evidence of previous experience with CHD was obtained from medical histories and ECG tracings. "Competitive" subjects (N=83) were matched with "noncompetitive" subjects (N=83) by similarities in age, race, ethnic group, diet, height, weight, and the amount of physical activity required by their jobs. A total of 42 unemployed blind subjects also were studied. The latter resembled the "noncompetitive" group in personality pattern but had the complicating factor of continual anxiety. At the time of observations, selectees first were categorized by one examiner as to whether their behavioral patterns, which had been selected to represent the extremes of contrast between "driving" and "easy-going" personalities, were completely or incompletely developed. (This was done for purposes of subclassification.) A detailed medical history was taken and a physical examination performed. Then a second examiner drew blood for determinations of cholesterol

and clotting time, measured bleeding time, and took ECG tracings. A third examiner gave detailed instructions that would permit selectees to record qualitative and quantitative information on dietary intake by daily diary technic for one week.

Short-term studies on small groups of CHD patients and selected control subjects are under way to refine current technics and to develop new and better methods. Endocrine-CHD hypotheses are being tested through utilization of data from urinalyses. Other studies now in progress are designed to measure personality traits by objective means. A "lie detector" that simultaneously records amplitude and rate of respiration, body movement, and cardiac function is under study. Also, a psychophysiological test is being devised in search of a predictor of the occurrence of CHD in specific groups of individuals.

20. North Dakota—In 1956-1957 a longitudinal study of CHD was started in a six-county area surrounding Grand Forks, N. D., to determine the feasibility of certain investigative methods and to test specific hypotheses concerning causation of this disease. (This area was selected for study because vital records had indicated that North Dakota reported the lowest death rate from CHD in the nation.) Patients developing acute manifestations of CHD, either as new or recurrent events, were reported by practicing physicians to the study center as the primary case-finding device. Also, physicians provided clinical and ECG findings on their CHD patients to assist a review committee of internists in deciding whether reported cases should be considered CHD for purposes of the study and in classifying them into subgroups. Monthly visits were made by an epidemiologist to each physician in the study area and bimonthly visits were made to physicians in areas bordering the six counties to improve the degree of reporting and to collect collateral information. Hospital records and mortality statistics were reviewed periodically to check the completeness of this case-finding method. A 10 per cent probability sample of dwelling units was chosen and residents therein were interviewed through Bureau of the Census enumerators for demographic and selected personal characteristics. These characteristics included data on occupation, smoking, and food habits as the principal areas of interest, and were determined through personal interviews with all males aged 35 years and over who came into the probability sample. A single dietitian made detailed dietary assessments of each recognized CHD patient, together with such assessments of two age-matched control subjects chosen for each patient from the probability sample. Attempt was made to establish the dietary pattern of patients for the month preceding overt disease and of control subjects for the month preceding the interview. If the CHD patient had died, his wife or nearest kin was interviewed as, in such instances, were comparable relatives of the matched control subjects. Thereafter standardized procedures were followed in estimating qualitative and quantitative intake of specific nutrients.

21. Chicago Board of Health—An ongoing study has been conducted in a Chicago utility company in search of factors of host and environment that predispose to or precipitate cardiovascular-renal morbidity and mortality, particularly ASHD and HHD. The health status, country of birth, social class, and occupational experience of 756 employees aged 50-59 years (96 per cent of the plant employees in this age class) were determined as of January, 1954, from preexisting records. Using serial observations from annual physical examinations conducted through plant facilities, a series of determinative analyses is in progress. (In

January, 1958, the study was enlarged to include the entire labor force aged 40-59 years, approximately 2,000 individuals.) Specific aims include the testing of hypotheses concerning associations between CVD and the following host and environmental characteristics: (a) place of birth (native or foreign born), (b) dietary habits and nutrition, (c) marital status, (d) physical activity, (e) psychologic stress, and (f) other factors.

A second study concerns the comparison of Negroes and whites with respect to patterns of cholesterolemia and incidence of CHD. Other correlates include age, sex, height, weight, occupation, industry, and duration of residence in northern states.

A third study, employing methods of experimental epidemiology, is designed to measure the effect of a nutritional-hygienic regimen on risk of developing CHD. Several hundred middle-aged men without evidence of CHD, but presumed to be at high risk by virtue of high levels of (a) body weight, (b) blood pressure, and (c) serum cholesterol, have been induced to follow a prescribed regimen and are being examined serially. They are being contrasted for coronary disease with appropriately matched control subjects from the Chicago utility company.

CO-CHAIRMAN'S ADDRESS*

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IN THE sessions of this conference I have not heard much about epidemiology or what epidemiology is. It seems to me we need to review the rather broad background of the things we are considering. I would like to refer to Paul Sears's comment about a scientist. He said, "Discovery and communication are the two prime obligations of a scientist." An occasion such as this gives a scientist an opportunity to examine some broad issues in the light of the special knowledge and experiences of those who are not epidemiologists. I hope that, even though our major concern is the epidemiological method applied to various types of heart disease, we shall endeavor to think in broad terms about applying such disciplines as mathematics, physics, chemistry, and other sciences to the problem at hand.

We should also bear in mind that we need to know something about biology in general and ecology in particular, if we are to learn more about man's relationship to his environment. We have not heard much about ecologists here, but I think that epidemiologists come close to being ecologists in their method. An ecologist, as you know, has a viewpoint just a little different from others in the scientific field. For one thing, he sees man as a social being in a cultural matrix, and powerfully affected by population dynamics.

Getting down to the specific point of epidemiology, I am delighted with Dr. Kendall's definition of epidemiology. (Report of the Subcommittee on Biochemical Measurements.) I would like to repeat it because it is stated perhaps better than many definitions made by epidemiologists themselves. Dr. Kendall said that the purpose of any epidemiological study is to evaluate the influence of diverse genetic and environmental factors upon the occurrence and severity of disease. I think this is particularly pertinent in the field of heart disease, where we have no demonstrated specific etiological agents.

The other remark he made that struck home had to do with differences in the mean levels of particular factors that might be statistically significant among diseased and control groups. He pointed out that values for the two groups are scattered over the same range and have little diagnostic or prognostic significance for any given individual. I would like to reemphasize that, strictly speaking, surveys of characteristics are not epidemiological studies; they do not relate the disease to specific environmental or genetic factors which characterize the populations under investigation. He pointed out that in many studies, biochemical determinations have been substituted either for an adequate study of the factors or for an ultimate appraisal of the clinical manifestations of the disease.

In the area of epidemiology, and particularly in heart disease, there are several things that need to be said about the viewpoint of those who work in epidemiology and who have epidemiological studies going on in areas

* On the third day of the Conference.

such as heart disease, cancer, automobile accidents, cerebral palsy, and birth defects. All these studies have a common denominator. I think it is particularly important that we talk about the methods of epidemiology because intrinsic in these studies is the use of statistical methods.

Unfortunately, certain groups in our country feel strongly that statistical studies on man are of relatively little value and inconclusive. These groups believe that the true facts can be ascertained only by animal experimentation and clinical observation. This is not said in criticism; this is merely an observation. We are often urged to take no public health action until laboratory and clinical studies have given ultimate answers about the nature of such diseases as cancer. This attack on the public health approach expresses a belief that is widely held. I think perhaps for that reason it is important to point out that epidemiological studies on man have been highly productive of scientific knowledge and of practical application in the advance of medical science. This does not in any way deprecate the value of animal experimentation in the laboratory or clinical investigation in the ward. I think these things are indispensable and certainly necessary for medical progress. But we must emphasize the true value of the epidemiological approach with its heavy reliance on statistical compilation in the analysis of events that occur in human populations.

I would like to make another point here that has not been mentioned in the last two days of discussion, and that is the interchangeability of medical statisticians and epidemiologists. The medical statistician is usually called a biostatistician and is, first of all, a mathematician who adapts his knowledge to the study of disease. The epidemiologist, on the other hand, is skilled in medicine, but has learned to adopt a mathematical approach in the study of disease among groups of people. Certainly, whenever possible, the two work together; in the process, the statistician becomes a better epidemiologist and the epidemiologist a better statistician, so that the two ultimately approach one another closely in their skills. Since the distinguishing feature of an epidemiological study is its use of numbers and their analysis by statistical methods and logic, it seems permissible, in the present discussion and in our future discussions in this area, to use the words "biostatistics and epidemiology" almost interchangeably.

Without going into great detail, I think it would be wise for all of us interested in epidemiology to go back to the era preceding knowledge of the bacterial and viral causes of disease to see the way in which some of the early workers used epidemiological methods. When Jenner did his work on smallpox 161 years ago, he handled his accounts and compiled his cases in such a way that he really carried out a neat epidemiological study. He knew nothing about the cause of the disease and yet he found out how to prevent the disease. John Snow's classic studies on cholera in 1854 are a parallel with what we are facing today in heart disease. Many of the same puzzles were faced by John Snow in his attempt to work out the relationships between cholera and the way in which the disease was transmitted. Michael Taylor in England studied epidemics of typhoid fever in 1857 and traced its transmission through milk. Again, he knew little about the cause, but he knew how to develop meaningful associations. So, as we trace epidemics back through the last century, we find many individual investigators confronted with precisely the same types of problems that we are facing at the present time in heart disease.

To bring this viewpoint up to date, I should like to point out that our

knowledge of carcinogenic agents, and the means of preventing certain types of neoplastic disease to the extent that we can, is largely the product of epidemiological studies. Certainly the early studies on scrotal cancer in chimney sweeps, on cancer from contact with spindle oil, on cancer of the bladder of aniline workers and on skin cancer from arsenic are all examples of the epidemiological approach. Many of you are familiar with some of the recent reports on the development of leukemia among those treated with x-rays for spondylitis, the effects on children of irradiation of the thymus and the increase of congenital deformities among babies whose mothers had pelvic x-ray examinations during pregnancy. Again these are examples of the methods we are talking about.;

I would like to read a short quotation from Dr. Frost, one of our foremost epidemiologists, who was my professor of epidemiology at the Johns Hopkins School of Hygiene and Public Health. He said: "The opinion is more or less prevalent that inference based upon epidemiological argument cannot be truly conclusive, because the evidence is purely circumstantial. Such opinion has frequently failed to take account of the whole mass of evidence and to follow the argument which is necessarily built up step by step in its somewhat complex and perhaps tedious way. Given sufficient scope and accuracy of observation, a conclusion as to the nature and spread of disease may often be established quite firmly by circumstantial evidence well in advance of experimental confirmation. Moreover, many problems of disease transmission, which are highly important from the standpoint of prevention, are of a type that can be solved only by investigations of this kind. The weakness in conclusions drawn from circumstantial studies is usually chargeable not to basic defects in the method of investigation, but. more often, to paucity or inaccuracy of data or to false logic in their interpretation."

Finally, I would like to say that in talking about epidemiology we must be cautious about the use of the word. We hear about "shoeleather" epidemiologists who go out into the field and learn things by doing their own work. We hear about "armchair" epidemiologists who have others gather their data. Now we have heard recently about clinical epidemiology. Dr. John Paul of Yale has just published a book* with that title. We hear also of experimental epidemiology. The point I wish to make here is that we need to consider epidemiology in its total context.

We also need to realize that many heart disease studies labeled epidemiological do not actually follow epidemiological methods in their design or execution. There is no reason why every study which sets out to describe characteristics of persons with heart disease should be called an epidemiological study. It is my hope that when clinical and laboratory researchers design and carry out epidemiological studies, they take care to study carefully and follow epidemiological methods. Only when a study employs epidemiological methods should it be labeled "epidemiological."

Good epidemiological studies are very difficult in coronary heart disease because the preclinical stages of atherosclerosis—the precursor of coronary heart disease—appear to be occurring almost universally among our adult population in the United States. When a disease is almost universal, the comparison of cases and noncases becomes almost impossible, except in post-mortem studies. Yet the comparison of cases with noncases comprises the basic method of epidemiology.

Difficulties notwithstanding, there re-

* Paul, John R. Clinical Epidemiology. University of Chicago Press, 1958.

mains a great need for more epidemiological studies of the classic pattern applied to the heart disease puzzle. Such studies, together with other studies on the clinical and laboratory scene, and embracing all of the scientific disciplines are needed. As we proceed to our separate studies, we should avoid any temptation to add up results indiscriminately. In this way, we will unravel the mysteries of heart disease, a goal that we share equally.

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